ORTJ0950

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Vapor-liquid equilibria of binary mixtures of methyl alkanoates + isomeric butanols

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Isobaric vapor-liquid measurements are reported at 101.32 10^3Pa *for methyl ethanoate, methyl propanoate, and methyl butanoate + 1-butanol, + 2-butanol, or + 2-methyl-1-propanol.*

1. INTRODUCTION

In continuation of the experimental studies carried out in our laboratory on vapor-liquid equilibria (VLE) of mixtures of esters and alcohols (**SUSP0890, ORTJ0905, ORTJ0906, ORTJ0907, ORTJ0934**), we present here isobaric measurements at 101.32 10^3Pa for methyl ethanoate, methyl propanoate, and methyl butanoate + isomeric butanols. Only a few data appear in the literature (**WICI0930**) for this class of systems (**PATV1771, BELV0870, PERV0800, FERJ1870**). Data for methyl propanoate + 2-methyl-1-propanol (**SUSP0930**) or + 1-butanol (**SUSP0931**) have been published previously. The purpose of these measurements is to compare the experimental data with those predicted by various group contribution models (see, e. g., **ORTJ0934**), and especially to study the effect of branching of the alkanol and of the position of the hydroxyl group.

2. EXPERIMENTAL SECTION

2.1. Apparatus and Procedure

An all-glass dynamic equilibrium still consisting of a boiling flask, Cottrell pump, and condenser was used (**ORTJ0860**). Equilibrium temperature T was measured by means of a high-precision Pt resistance thermometer (Comark-6800, UK) calibrated against IPTS-68 to within $\sigma(T)/K = 0.02$. Pressure P was measured using a quartz Bourdon tube pressure gauge (MKS Inst., Model 270 B, France) to within $\sigma(P)/Pa = 20$.

Samples of liquid and condensed vapor were taken at intervals of 30-40 min. The liquid-phase x and vapor-phase y mole fractions were determined with a digital densimeter (Anton Paar, Model DMA-55, Austria) to within $\sigma(x_i) = 0.001$ and $\sigma(y_i) = 0.002$. The calibration curves were based on densities of synthetically prepared mixtures.

2.2. Materials

$C_3H_6O_2$, Methyl ethanoate (Methyl acetate). Fluka AG (Buchs, Switzerland) "purum" grade material of stated purity > 99 mole %, degassed ultrasonically, dried over molecular sieves Type 3A (reference 69828, from Fluka), and used without further purification. n(D,298.15 K) = 1.3589; ρ_i(298.15 K)/kg m^{-3} = 927.07.

$C_4H_8O_2$, Methyl propanoate (Methyl propionate). Fluka AG (Buchs, Switzerland) "purum" grade material of stated purity > 99 mole %, purified as above. n(D,298.15 K) = 1.3745; ρ_i(298.15 K)/kg m^{-3} = 908.86.

$C_4H_{10}O$, 1-Butanol (Butyl alcohol). Fluka AG (Buchs, Switzerland) "puriss p. a." grade material of stated purity > 99.5 mole % purified as above. n(D,298.15 K) = 1.3974; ρ_i(298.15 K)/kg m^{-3} = 805.93.

$C_4H_{10}O$, 2-Butanol (sec-Butyl alcohol). Fluka AG (Buchs, Switzerland) "puriss p. a." grade material of stated purity > 99.0 mole % purified as above. n(D,298.15 K) = 1.3953; ρ_i(298.15 K)/kg m^{-3} = 802.36.

$C_4H_{10}O$, 2-Methyl-1-propanol (Isobutyl alcohol). Fluka AG (Buchs, Switzerland) "puriss p. a." grade material of stated purity > 99.5 mole % purified as above. n(D,298.15 K) = 1.3939; ρ_i(298.15 K)/kg m^{-3} = 797.83.

$C_5H_{10}O_2$, Methyl butanoate (Methyl butyrate). Fluka AG (Buchs, Switzerland) "purum" grade material of stated purity > 99.0 mole %, purified as above. n(D,298.15 K) = 1.3849; ρ_i(298.15 K)/kg m^{-3} = 892.61.

3. RESULTS

All the isobaric measurements were performed at (101.32 ± 0.01)10^3Pa. The direct experimental values are tabulated and graphed in the Appendix and saved on disk as Standard ELDATA Files **ORTJ0950.001** through **ORTJ0950.018.**

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Ortega, Juan* [ORTJ0]

Susial, Pedro [SUSP0]

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Property Code: [EVLM0001] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.001**

State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid

Parameters: [P1] P/Pa, Pressure

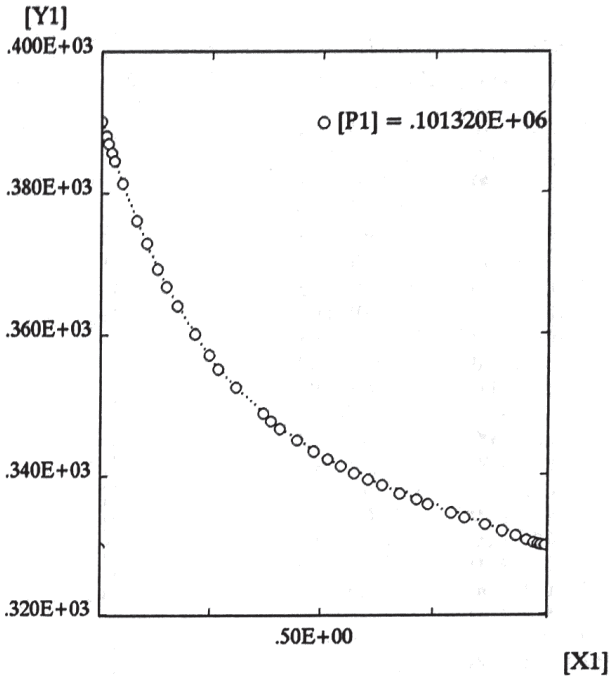
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] T/K, Temperature

Method: Direct measurement of T at variable x_1 and constant P

Components: **1. $C_3H_6O_2$, Methyl ethanoate**
2. $C_4H_{10}O$, 1-Butanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.390230E+03	.678700E+00	.337320E+03
.113000E−01	.388160E+03	.717000E+00	.336540E+03
.169000E−01	.387030E+03	.742000E+00	.335900E+03
.236000E−01	.385790E+03	.792800E+00	.334660E+03
.304000E−01	.384570E+03	.822500E+00	.333930E+03
.491000E−01	.381370E+03	.867200E+00	.332940E+03
.828000E−01	.376010E+03	.905500E+00	.332030E+03
.104800E+00	.372820E+03	.934400E+00	.331320E+03
.131100E+00	.369280E+03	.958100E+00	.330750E+03
.151000E+00	.366790E+03	.974500E+00	.330360E+03
.176400E+00	.364020E+03	.983500E+00	.330150E+03
.215800E+00	.360010E+03	.989400E+00	.330010E+03
.249000E+00	.357080E+03	.100000E+01	.329910E+03
.270300E+00	.355270E+03		
.309400E+00	.352430E+03		
.372700E+00	.348710E+03		
.390100E+00	.347620E+03		
.410500E+00	.346560E+03		
.448800E+00	.344930E+03		
.487000E+00	.343360E+03		
.517500E+00	.342240E+03		
.547400E+00	.341210E+03		
.577200E+00	.340290E+03		
.607900E+00	.339360E+03		
.640300E+00	.338520E+03		



Property Code: [EVLM0002] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.002**

State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid

Parameters: [P1] P/Pa, Pressure

Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] y_1/-, Mole fraction of component 1 in vapor phase

Method: Direct measurement of y_1 at variable x_1 and constant P

Components: **1. $C_3H_6O_2$, Methyl ethanoate**
2. $C_4H_{10}O$, 1-Butanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.000000E+00	.678700E+00	.951700E+00
.113000E−01	.883000E−01	.717000E+00	.957000E+00
.169000E−01	.127500E+00	.742000E+00	.960600E+00
.236000E−01	.172500E+00	.792800E+00	.968300E+00
.304000E−01	.212600E+00	.822500E+00	.972400E+00
.491000E−01	.311500E+00	.867200E+00	.978800E+00
.828000E−01	.456700E+00	.905500E+00	.984100E+00
.104800E+00	.531500E+00	.934400E+00	.988500E+00
.131100E+00	.605100E+00	.958100E+00	.991900E+00
.151000E+00	.650900E+00	.974500E+00	.994500E+00
.176400E+00	.697900E+00	.983500E+00	.996100E+00
.215800E+00	.757200E+00	.989400E+00	.997000E+00
.249000E+00	.793100E+00	.100000E+01	.100000E+01
.270300E+00	.813000E+00		
.309400E+00	.840800E+00		
.372700E+00	.873200E+00		
.390100E+00	.881700E+00		
.410500E+00	.889900E+00		
.448800E+00	.902600E+00		
.487000E+00	.913200E+00		
.517500E+00	.920100E+00		
.547400E+00	.927100E+00		
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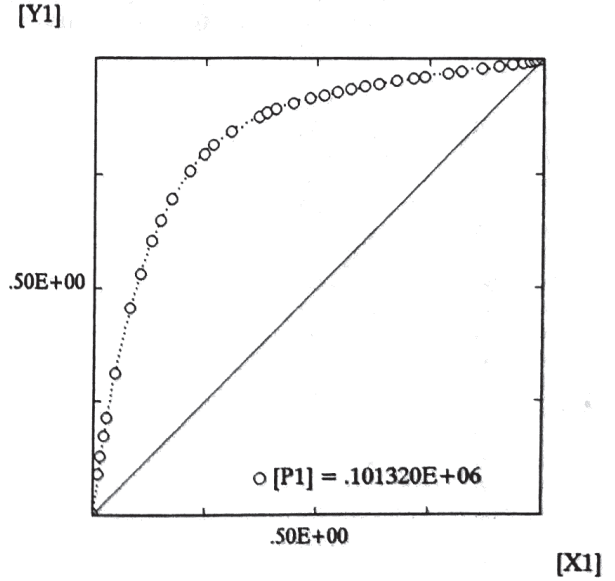

Property Code: [EVLM0001] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.003**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] T/K, Temperature
Method: Direct measurement of T at variable x_1 and constant P

Components: **1. $C_3H_6O_2$, Methyl ethanoate**
2. $C_4H_{10}O$, 2-Butanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.372360E+03	.942300E+00	.330920E+03
.213000E−01	.370280E+03	.969900E+00	.330340E+03
.270000E−01	.369800E+03	.100000E+01	.329910E+03
.571000E−01	.367090E+03		
.136300E+00	.360400E+03		
.157400E+00	.358300E+03		
.180500E+00	.356580E+03		
.202900E+00	.355070E+03		
.225400E+00	.353690E+03		
.244400E+00	.352400E+03		
.267900E+00	.351110E+03		
.296800E+00	.349480E+03		
.320500E+00	.348330E+03		
.343000E+00	.347280E+03		
.366900E+00	.346300E+03		
.402300E+00	.345030E+03		
.423200E+00	.344530E+03		
.462300E+00	.343040E+03		
.513900E+00	.342050E+03		
.610900E+00	.338700E+03		
.673800E+00	.337370E+03		
.760100E+00	.335180E+03		
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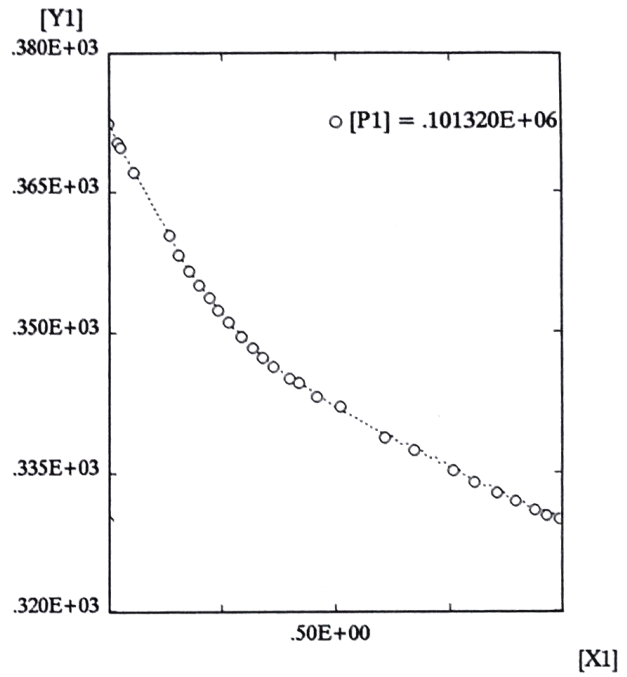

Property Code: [EVLM0002] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.004**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] y_1/-, Mole fraction of component 1 in vapor phase
Method: Direct measurement of y_1 at variable x_1 and constant P

Components: **1. $C_3H_6O_2$, Methyl ethanoate**
2. $C_4H_{10}O$, 2-Butanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.000000E+00	.942300E+00	.982900E+00
.213000E−01	.987000E−01	.969900E+00	.990800E+00
.270000E−01	.120000E+00	.100000E+01	.100000E+01
.571000E−01	.232700E+00		
.136300E+00	.445300E+00		
.157400E+00	.496000E+00		
.180500E+00	.540700E+00		
.202900E+00	.578300E+00		
.225400E+00	.609000E+00		
.244400E+00	.637500E+00		
.267900E+00	.665300E+00		
.296800E+00	.696100E+00		
.320500E+00	.718000E+00		
.343000E+00	.737100E+00		
.366900E+00	.754700E+00		
.402300E+00	.777700E+00		
.423200E+00	.786800E+00		
.462300E+00	.811900E+00		
.513900E+00	.831500E+00		
.610900E+00	.879100E+00		
.673800E+00	.894700E+00		
.760100E+00	.923700E+00		
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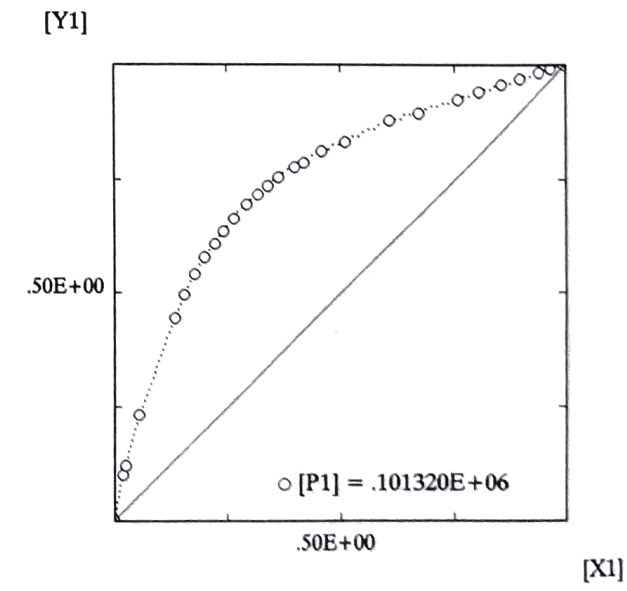

Property Code: [EVLM0001] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.005**

State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid

Parameters: [P1] P/Pa, Pressure

Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] T/K, Temperature

Method: Direct measurement of T at variable x_1 and constant P

Components: **1. $C_3H_6O_2$, Methyl ethanoate**
2. $C_4H_{10}O$, 2-Methyl-1-propanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.380390E+03	.708500E+00	.336190E+03
.191000E−01	.377180E+03	.747300E+00	.335380E+03
.316000E−01	.375400E+03	.780500E+00	.334560E+03
.572000E−01	.371960E+03	.815300E+00	.333760E+03
.723000E−01	.370120E+03	.845500E+00	.333090E+03
.155000E+00	.361810E+03	.871200E+00	.332520E+03
.176500E+00	.359830E+03	.898800E+00	.331880E+03
.193600E+00	.358340E+03	.923700E+00	.331370E+03
.209100E+00	.357050E+03	.941500E+00	.330970E+03
.253700E+00	.353790E+03	.954500E+00	.330690E+03
.274700E+00	.352330E+03	.969600E+00	.330350E+03
.306000E+00	.350700E+03	.980300E+00	.330100E+03
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.402100E+00	.345860E+03		
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.455600E+00	.343580E+03		
.486100E+00	.342600E+03		
.513300E+00	.341620E+03		
.549500E+00	.340630E+03		
.575300E+00	.339650E+03		
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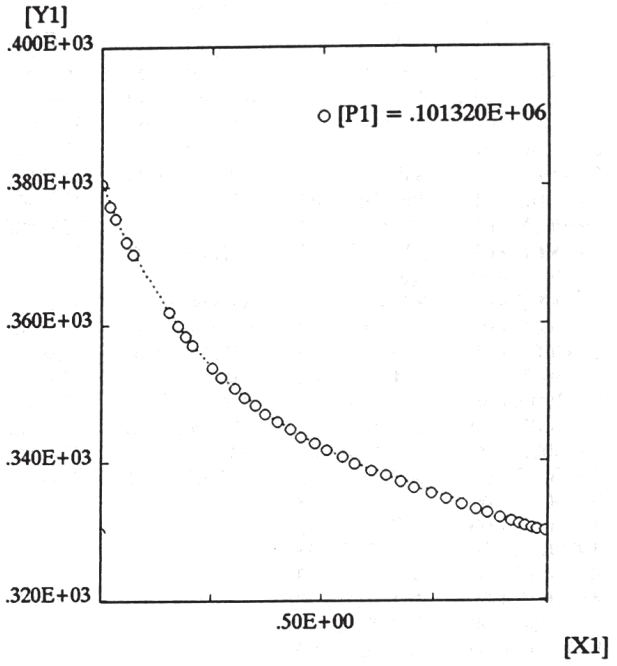

Property Code: [EVLM0002] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.006**

State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid

Parameters: [P1] P/Pa, Pressure

Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] y_1/-, Mole fraction of component 1 in vapor phase

Method: Direct measurement of y_1 at variable x_1 and constant P

Components: **1. $C_3H_6O_2$, Methyl ethanoate**
2. $C_4H_{10}O$, 2-Methyl-1-propanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.000000E+00	.708500E+00	.938200E+00
.191000E−01	.146300E+00	.747300E+00	.946900E+00
.316000E−01	.201700E+00	.780500E+00	.953500E+00
.572000E−01	.303600E+00	.815300E+00	.960800E+00
.723000E−01	.358600E+00	.845500E+00	.966900E+00
.155000E+00	.581700E+00	.871200E+00	.972100E+00
.176500E+00	.624700E+00	.898800E+00	.978300E+00
.193600E+00	.653800E+00	.923700E+00	.983300E+00
.209100E+00	.678600E+00	.941500E+00	.987000E+00
.253700E+00	.734600E+00	.954500E+00	.989900E+00
.274700E+00	.755000E+00	.969600E+00	.993400E+00
.306000E+00	.781800E+00	.980300E+00	.995700E+00
.327100E+00	.799500E+00	.100000E+01	.100000E+01
.351800E+00	.814400E+00		
.374000E+00	.827800E+00		
.402100E+00	.843000E+00		
.432600E+00	.856700E+00		
.455600E+00	.866300E+00		
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.513300E+00	.887000E+00		
.549500E+00	.897200E+00		
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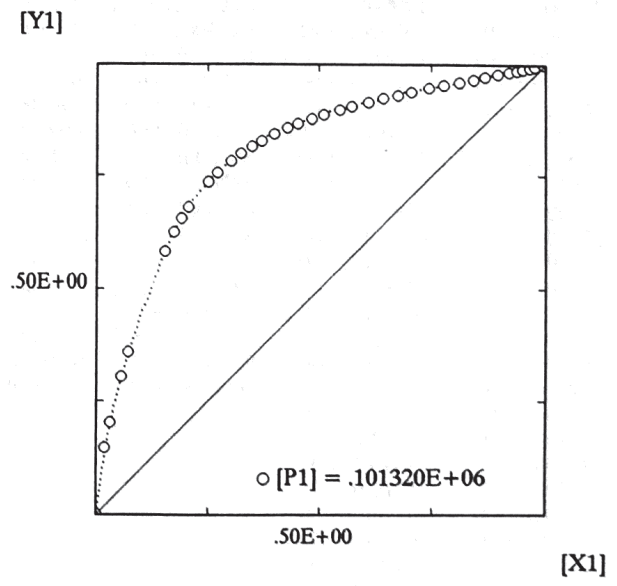
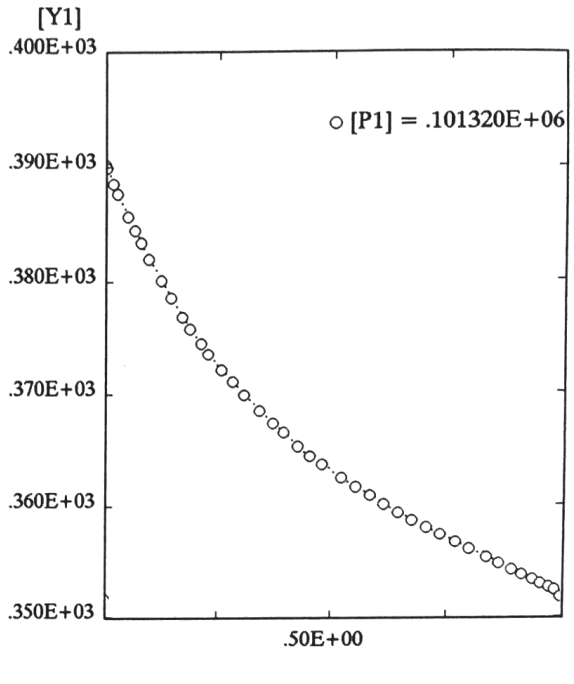


Property Code: [EVLM0001] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.007**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] T/K, Temperature
Method: Direct measurement of T at variable x_1 and constant P

Components: **1. $C_4H_8O_2$, Methyl propanoate**
2. $C_4H_{10}O$, 1-Butanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.390230E+03	.586100E+00	.360900E+03
.440000E−02	.389920E+03	.616500E+00	.360070E+03
.182000E−01	.388560E+03	.648300E+00	.359350E+03
.280000E−01	.387650E+03	.677900E+00	.358680E+03
.513000E−01	.385670E+03	.709200E+00	.358010E+03
.662000E−01	.384450E+03	.737900E+00	.357380E+03
.799000E−01	.383380E+03	.771600E+00	.356690E+03
.969000E−01	.381960E+03	.801200E+00	.356100E+03
.126300E+00	.380120E+03	.837600E+00	.355320E+03
.148000E+00	.378620E+03	.865600E+00	.354770E+03
.172500E+00	.376880E+03	.893100E+00	.354230E+03
.189800E+00	.375860E+03	.915000E+00	.353800E+03
.214600E+00	.374560E+03	.938500E+00	.353320E+03
.229700E+00	.373620E+03	.956000E+00	.352990E+03
.259800E+00	.372180E+03	.973800E+00	.352660E+03
.284600E+00	.371090E+03	.987200E+00	.352410E+03
.309700E+00	.369900E+03	.100000E+01	.351770E+03
.344000E+00	.368450E+03		
.373700E+00	.367350E+03		
.397200E+00	.366530E+03		
.428300E+00	.365300E+03		
.454800E+00	.364430E+03		
.481600E+00	.363650E+03		
.523500E+00	.362460E+03		
.554800E+00	.361660E+03		

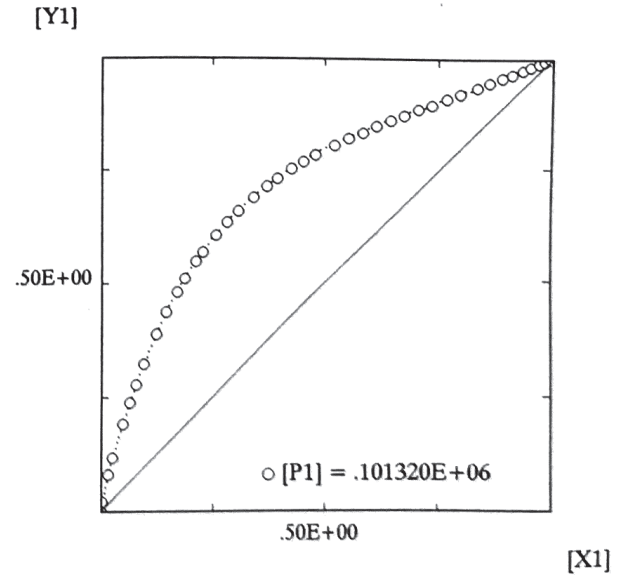


Property Code: [EVLM0002] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.008**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] y_1/-, Mole fraction of component 1 in vapor phase
Method: Direct measurement of y_1 at variable x_1 and constant P

Components: **1. $C_4H_8O_2$, Methyl propanoate**
2. $C_4H_{10}O$, 1-Butanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.000000E+00	.586100E+00	.833800E+00
.440000E−02	.199000E−01	.616500E+00	.848600E+00
.182000E−01	.787000E−01	.648300E+00	.861100E+00
.280000E−01	.116800E+00	.677900E+00	.873200E+00
.513000E−01	.192000E+00	.709200E+00	.886200E+00
.662000E−01	.238200E+00	.737900E+00	.896800E+00
.799000E−01	.278000E+00	.771600E+00	.909800E+00
.969000E−01	.323100E+00	.801200E+00	.921400E+00
.126300E+00	.388800E+00	.837600E+00	.934900E+00
.148000E+00	.436700E+00	.865600E+00	.945700E+00
.172500E+00	.480200E+00	.893100E+00	.956300E+00
.189800E+00	.510400E+00	.915000E+00	.965500E+00
.214600E+00	.547800E+00	.938500E+00	.974600E+00
.229700E+00	.567800E+00	.956000E+00	.981800E+00
.259800E+00	.604800E+00	.973800E+00	.989300E+00
.284600E+00	.633700E+00	.987200E+00	.994800E+00
.309700E+00	.658900E+00	.100000E+01	.100000E+01
.344000E+00	.688200E+00		
.373700E+00	.712820E+00		
.397200E+00	.730400E+00		
.428300E+00	.753100E+00		
.454800E+00	.768000E+00		
.481600E+00	.783800E+00		
.523500E+00	.804900E+00		
.554800E+00	.820500E+00		

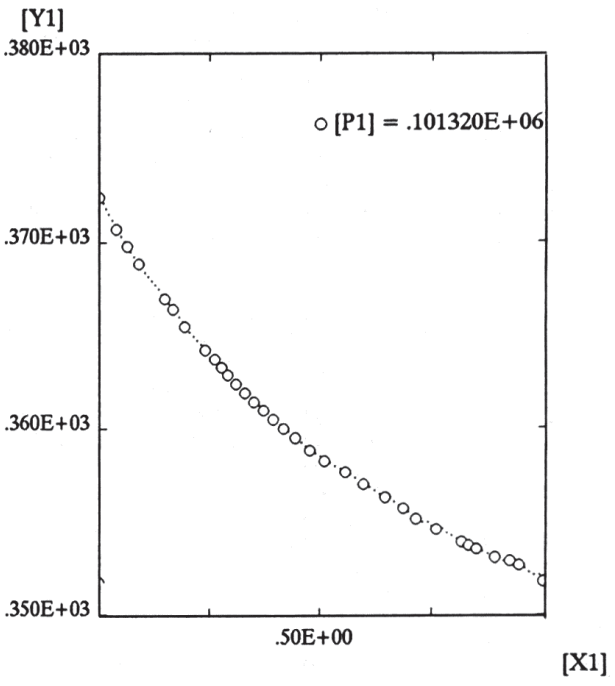


Property Code: [EVLM0001] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.009**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] T/K, Temperature
Method: Direct measurement of T at variable x_1 and constant P

Components: **1. $C_4H_8O_2$, Methyl propanoate**
2. $C_4H_{10}O$, 2-Butanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.372360E+03	.762900E+00	.354570E+03
.397000E−01	.370680E+03	.819900E+00	.353870E+03
.644000E−01	.369800E+03	.835500E+00	.353680E+03
.910000E−01	.368840E+03	.853000E+00	.353520E+03
.151100E+00	.366980E+03	.893000E+00	.353060E+03
.169300E+00	.366390E+03	.925200E+00	.352860E+03
.196000E+00	.365450E+03	.946400E+00	.352660E+03
.243500E+00	.364190E+03	.100000E+01	.351770E+03
.265600E+00	.363700E+03		
.279900E+00	.363270E+03		
.294000E+00	.362860E+03		
.313800E+00	.362340E+03		
.333400E+00	.361850E+03		
.353800E+00	.361380E+03		
.375400E+00	.360920E+03		
.397800E+00	.360430E+03		
.420900E+00	.359970E+03		
.446900E+00	.359450E+03		
.479800E+00	.358810E+03		
.513700E+00	.358230E+03		
.560500E+00	.357630E+03		
.600300E+00	.356990E+03		
.648900E+00	.356270E+03		
.690100E+00	.355690E+03		
.717200E+00	.355120E+03		

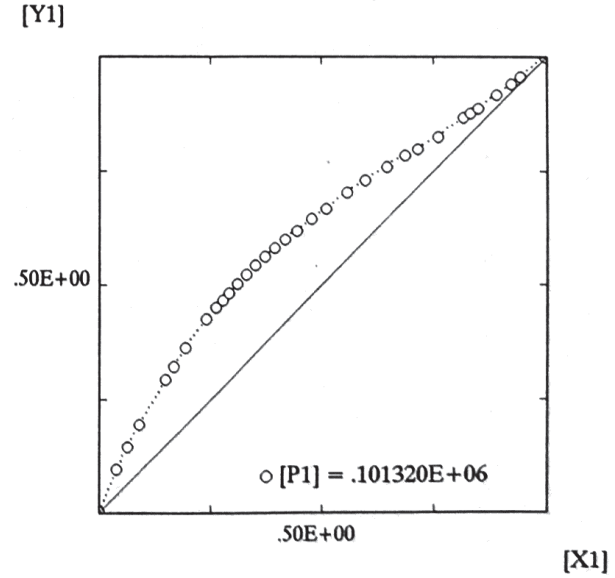


Property Code: [EVLM0002] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.010**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] y_1/-, Mole fraction of component 1 in vapor phase
Method: Direct measurement of y_1 at variable x_1 and constant P

Components: **1. $C_4H_8O_2$, Methyl propanoate**
2. $C_4H_{10}O$, 2-Butanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.000000E+00	.762900E+00	.824200E+00
.397000E−01	.941000E−01	.819900E+00	.866000E+00
.644000E−01	.144300E+00	.835500E+00	.876300E+00
.910000E−01	.195300E+00	.853000E+00	.887300E+00
.151100E+00	.295100E+00	.893000E+00	.915800E+00
.169300E+00	.323300E+00	.925200E+00	.939700E+00
.196000E+00	.363800E+00	.946400E+00	.956100E+00
.243500E+00	.425900E+00	.100000E+01	.100000E+01
.265600E+00	.450400E+00		
.279900E+00	.465900E+00		
.294000E+00	.481300E+00		
.313800E+00	.502400E+00		
.333400E+00	.523100E+00		
.353800E+00	.542400E+00		
.375400E+00	.561500E+00		
.397800E+00	.580300E+00		
.420900E+00	.599200E+00		
.446900E+00	.618700E+00		
.479800E+00	.644600E+00		
.513700E+00	.666600E+00		
.560500E+00	.702500E+00		
.600300E+00	.728300E+00		
.648900E+00	.757900E+00		
.690100E+00	.784100E+00		
.717200E+00	.798200E+00		

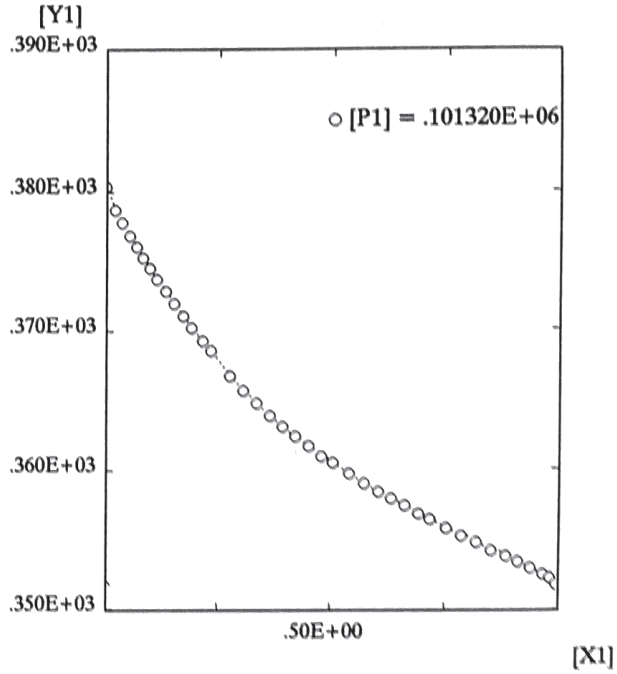


Property Code: [EVLM0001] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.011**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] T/K, Temperature
Method: Direct measurement of T at variable x_1 and constant P

Components: **1. $C_4H_8O_2$, Methyl propanoate**
2. $C_4H_{10}O$, 2-Methyl-1-propanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.380390E+03	.607300E+00	.358410E+03
.214000E−01	.378710E+03	.635700E+00	.357910E+03
.362000E−01	.377830E+03	.664200E+00	.357420E+03
.534000E−01	.376870E+03	.694700E+00	.356830E+03
.690000E−01	.376080E+03	.719100E+00	.356410E+03
.840000E−01	.375270E+03	.756000E+00	.355760E+03
.997000E−01	.374500E+03	.787700E+00	.355230E+03
.115500E+00	.373700E+03	.821000E+00	.354770E+03
.134700E+00	.372850E+03	.854300E+00	.354170E+03
.153500E+00	.371970E+03	.886000E+00	.353760E+03
.173600E+00	.371080E+03	.912500E+00	.353380E+03
.193500E+00	.370220E+03	.940900E+00	.352920E+03
.217400E+00	.369300E+03	.968900E+00	.352460E+03
.236200E+00	.368560E+03	.984400E+00	.352200E+03
.279400E+00	.366780E+03	.100000E+01	.351770E+03
.308900E+00	.365720E+03		
.338600E+00	.364820E+03		
.367300E+00	.363910E+03		
.395500E+00	.363140E+03		
.423900E+00	.362410E+03		
.453200E+00	.361740E+03		
.482700E+00	.360980E+03		
.507500E+00	.360510E+03		
.542700E+00	.359720E+03		
.575700E+00	.359030E+03		

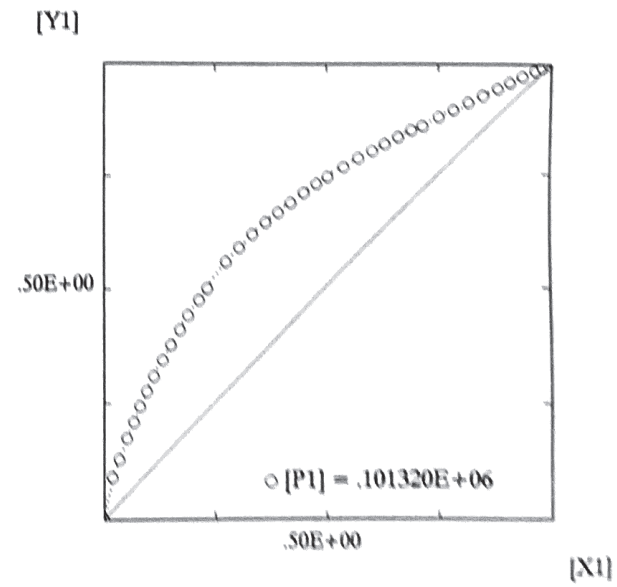


Property Code: [EVLM0002] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.012**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] y_1/-, Mole fraction of component 1 in vapor phase
Method: Direct measurement of y_1 at variable x_1 and constant P

Components: **1. $C_4H_8O_2$, Methyl propanoate**
2. $C_4H_{10}O$, 2-Methyl-1-propanol

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.000000E+00	.607300E+00	.804300E+00
.214000E−01	.884000E−01	.635700E+00	.819200E+00
.362000E−01	.127900E+00	.664200E+00	.835000E+00
.534000E−01	.172000E+00	.694700E+00	.850100E+00
.690000E−01	.208100E+00	.719100E+00	.860700E+00
.840000E−01	.243400E+00	.756000E+00	.990400E+00
.997000E−01	.275500E+00	.787700E+00	.896000E+00
.115500E+00	.309000E+00	.821000E+00	.912500E+00
.134700E+00	.344900E+00	.854300E+00	.929100E+00
.153500E+00	.377000E+00	.886000E+00	.944600E+00
.173600E+00	.410000E+00	.912500E+00	.958100E+00
.193500E+00	.441200E+00	.940900E+00	.972000E+00
.217400E+00	.475000E+00	.968900E+00	.985300E+00
.236200E+00	.499900E+00	.984400E+00	.992600E+00
.279400E+00	.557000E+00	.100000E+01	.100000E+01
.308900E+00	.589000E+00		
.338600E+00	.617700E+00		
.367300E+00	.645300E+00		
.395500E+00	.666400E+00		
.423900E+00	.689000E+00		
.453200E+00	.710300E+00		
.482700E+00	.730000E+00		
.507500E+00	.746800E+00		
.542700E+00	.767900E+00		
.575700E+00	.787900E+00		



Property Code: [EVLM0001] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.013**

State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid

Parameters: [P1] P/Pa, Pressure

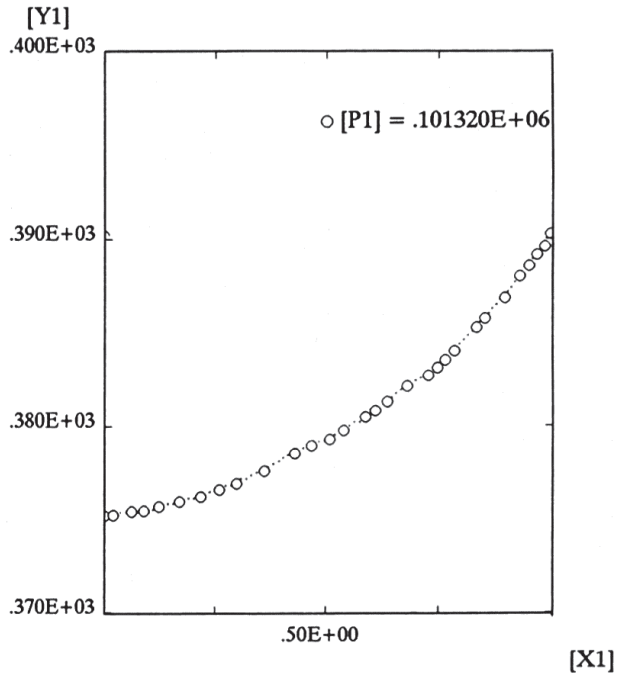
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] T/K, Temperature

Method: Direct measurement of T at variable x_1 and constant P

Components: **1. $C_4H_{10}O$, 1-Butanol**
2. $C_5H_{10}O_2$, Methyl butanoate

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.375150E+03	.931600E+00	.387930E+03
.206000E−01	.375180E+03	.952100E+00	.388500E+03
.635000E−01	.375390E+03	.968900E+00	.389120E+03
.913000E−01	.375420E+03	.987400E+00	.389550E+03
.125800E+00	.375640E+03	.100000E+01	.390230E+03
.173200E+00	.375890E+03		
.221000E+00	.376160E+03		
.263500E+00	.376540E+03		
.302800E+00	.376870E+03		
.364600E+00	.377560E+03		
.434300E+00	.378490E+03		
.471500E+00	.378920E+03		
.511800E+00	.379240E+03		
.542200E+00	.379740E+03		
.591400E+00	.380450E+03		
.613000E+00	.380800E+03		
.639800E+00	.381280E+03		
.683100E+00	.382110E+03		
.729800E+00	.382660E+03		
.751300E+00	.383080E+03		
.768700E+00	.383480E+03		
.788800E+00	.383980E+03		
.836700E+00	.385190E+03		
.855600E+00	.385710E+03		
.898500E+00	.386770E+03		



Property Code: [EVLM0002] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.014**

State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid

Parameters: [P1] P/Pa, Pressure

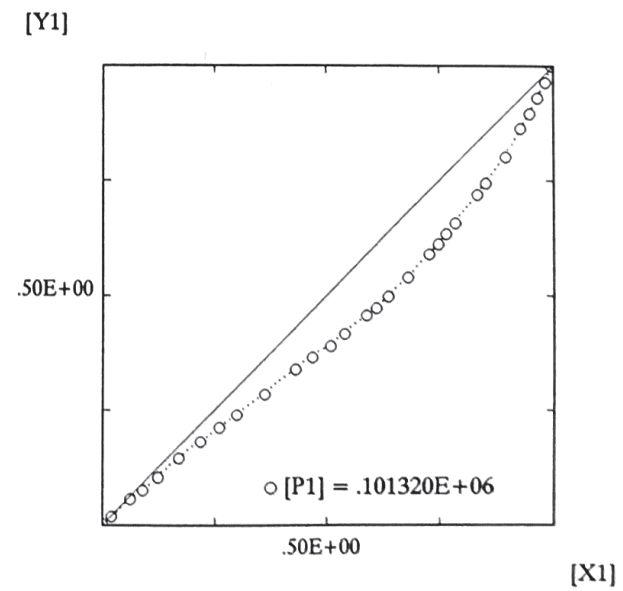
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] y_1/-, Mole fraction of component 1 in vapor phase

Method: Direct measurement of y_1 at variable x_1 and constant P

Components: **1. $C_4H_{10}O$, 1-Butanol**
2. $C_5H_{10}O_2$, Methyl butanoate

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.000000E+00	.931600E+00	.863500E+00
.206000E−01	.166000E−01	.952100E+00	.895700E+00
.635000E−01	.537000E−01	.968900E+00	.930300E+00
.913000E−01	.725000E−01	.987400E+00	.965100E+00
.125800E+00	.100600E+00	.100000E+01	.100000E+01
.173200E+00	.143600E+00		
.221000E+00	.178400E+00		
.263500E+00	.209700E+00		
.302800E+00	.238500E+00		
.364600E+00	.283300E+00		
.434300E+00	.337900E+00		
.471500E+00	.364800E+00		
.511800E+00	.390100E+00		
.542200E+00	.416000E+00		
.591400E+00	.456900E+00		
.613000E+00	.473100E+00		
.639800E+00	.498100E+00		
.683100E+00	.537800E+00		
.729800E+00	.587600E+00		
.751300E+00	.610700E+00		
.768700E+00	.632300E+00		
.788800E+00	.656100E+00		
.836700E+00	.717200E+00		
.855600E+00	.743700E+00		
.898500E+00	.800300E+00		



Property Code: [EVLM0001] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.015**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] T/K, Temperature
Method: Direct measurement of T at variable x_1 and constant P

Components: **1. $C_4H_{10}O$, 2-Butanol**
2. $C_5H_{10}O_2$, Methyl butanoate

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.375150E+03	.820100E+00	.370980E+03
.830001E−02	.375110E+03	.864200E+00	.371220E+03
.194000E−01	.375070E+03	.890300E+00	.371390E+03
.382000E−01	.374770E+03	.914500E+00	.371540E+03
.701000E−01	.374230E+03	.935500E+00	.371660E+03
.100800E+00	.373730E+03	.966700E+00	.371950E+03
.133400E+00	.373350E+03	.979900E+00	.372130E+03
.165100E+00	.372970E+03	.992900E+00	.372360E+03
.196900E+00	.372640E+03	.100000E+01	.372360E+03
.225400E+00	.372390E+03		
.297500E+00	.371810E+03		
.339500E+00	.371530E+03		
.368400E+00	.371390E+03		
.457200E+00	.370800E+03		
.506200E+00	.370770E+03		
.538000E+00	.370700E+03		
.569300E+00	.370660E+03		
.599500E+00	.370630E+03		
.627200E+00	.370630E+03		
.655100E+00	.370640E+03		
.686500E+00	.370660E+03		
.712000E+00	.370690E+03		
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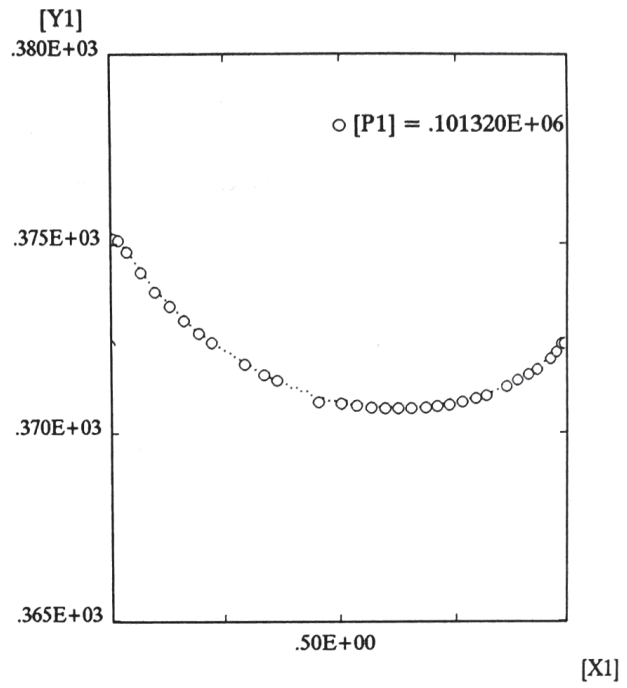
.796600E+00	.370900E+03		



Property Code: [EVLM0002] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.016**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] y_1/-, Mole fraction of component 1 in vapor phase
Method: Direct measurement of y_1 at variable x_1 and constant P

Components: **1. $C_4H_{10}O$, 2-Butanol**
2. $C_5H_{10}O_2$, Methyl butanoate

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.000000E+00	.820100E+00	.792100E+00
.830001E−02	.136000E−01	.864200E+00	.838500E+00
.194000E−01	.304000E−01	.890300E+00	.865800E+00
.382000E−01	.594000E−01	.914500E+00	.893500E+00
.701000E−01	.109600E+00	.935500E+00	.915800E+00
.100800E+00	.154200E+00	.966700E+00	.954900E+00
.133400E+00	.194000E+00	.979900E+00	.972200E+00
.165100E+00	.231600E+00	.992900E+00	.989300E+00
.196900E+00	.265100E+00	.100000E+01	.100000E+01
.225400E+00	.293600E+00		
.297500E+00	.360800E+00		
.339500E+00	.400800E+00		
.368400E+00	.421800E+00		
.457200E+00	.492400E+00		
.506200E+00	.526800E+00		
.538000E+00	.553800E+00		
.569300E+00	.576100E+00		
.599500E+00	.598000E+00		
.627200E+00	.621600E+00		
.655100E+00	.645300E+00		
.686500E+00	.670600E+00		
.712000E+00	.692600E+00		
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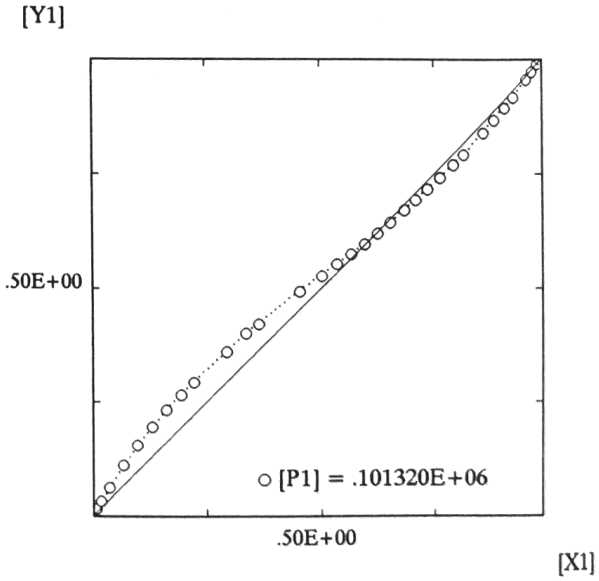
.766900E+00	.741700E+00		
.796600E+00	.768900E+00		

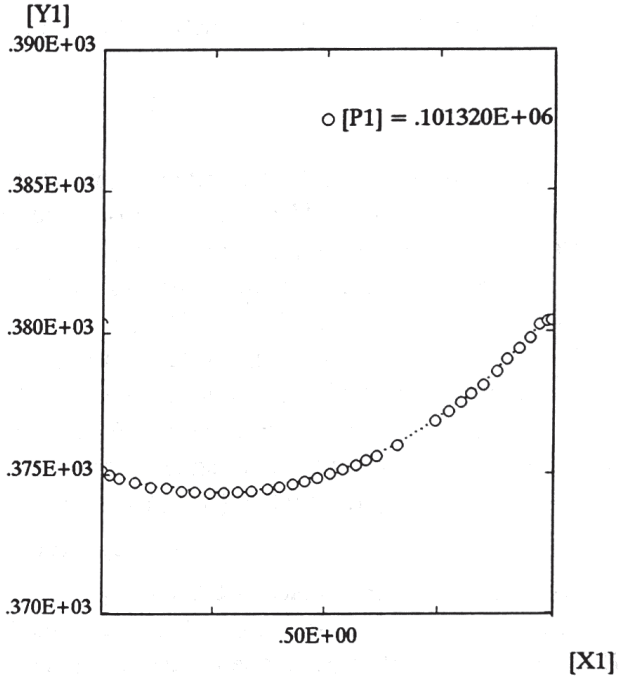


Property Code: [EVLM0001] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.017**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] T/K, Temperature
Method: Direct measurement of T at variable x_1 and constant P

Components: **1. $C_4H_{10}O$, 2-Methyl-1-propanol**
2. $C_5H_{10}O_2$, Methyl butanoate

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.375150E+03	.802400E+00	.377510E+03
.180000E−01	.374990E+03	.824200E+00	.377820E+03
.403000E−01	.374850E+03	.851000E+00	.378110E+03
.754000E−01	.374700E+03	.879700E+00	.378580E+03
.112200E+00	.374550E+03	.901600E+00	.379010E+03
.147600E+00	.374500E+03	.929600E+00	.379380E+03
.181700E+00	.374400E+03	.952700E+00	.379750E+03
.212000E+00	.374350E+03	.971900E+00	.380240E+03
.246300E+00	.374320E+03	.989300E+00	.380370E+03
.277800E+00	.374330E+03	.100000E+01	.380390E+03
.307900E+00	.374350E+03		
.339900E+00	.374400E+03		
.375900E+00	.374450E+03		
.402300E+00	.374540E+03		
.431300E+00	.374640E+03		
.458100E+00	.374730E+03		
.486600E+00	.374870E+03		
.515400E+00	.375020E+03		
.542400E+00	.375170E+03		
.572400E+00	.375310E+03		
.594600E+00	.375480E+03		
.618000E+00	.375650E+03		
.662500E+00	.376020E+03		
.746400E+00	.376870E+03		
.775700E+00	.377180E+03		



Property Code: [EVLM0002] VAPOR-LIQUID EQUILIBRIUM IN MIXTURES AND SOLUTIONS **ORTJ0950.018**
State: Two-component system, single-phase liquid
Pure component 1, liquid
Pure component 2, liquid
Parameters: [P1] P/Pa, Pressure
Variables: [X1] x_1/-, Mole fraction of component 1 in liquid phase
[Y1] y_1/-, Mole fraction of component 1 in vapor phase
Method: Direct measurement of y_1 at variable x_1 and constant P

Components: **1. $C_4H_{10}O$, 2-Methyl-1-propanol**
2. $C_5H_{10}O_2$, Methyl butanoate

[P1] = .101320E+06

[X1]	[Y1]	[X1]	[Y1]
.000000E+00	.000000E+00	.802400E+00	.721400E+00
.180000E−01	.209000E−01	.824200E+00	.748300E+00
.403000E−01	.468000E−01	.851000E+00	.779600E+00
.754000E−01	.863000E−01	.879700E+00	.814500E+00
.112200E+00	.123800E+00	.901600E+00	.849900E+00
.147600E+00	.157800E+00	.929600E+00	.887700E+00
.181700E+00	.191700E+00	.952700E+00	.918800E+00
.212000E+00	.220500E+00	.971900E+00	.954000E+00
.246300E+00	.251500E+00	.989300E+00	.978200E+00
.277800E+00	.278000E+00	.100000E+01	.100000E+01
.307900E+00	.305500E+00		
.339900E+00	.331800E+00		
.375900E+00	.356800E+00		
.402300E+00	.379000E+00		
.431300E+00	.402300E+00		
.458100E+00	.424800E+00		
.486600E+00	.449600E+00		
.515400E+00	.472800E+00		
.542400E+00	.494400E+00		
.572400E+00	.514900E+00		
.594600E+00	.535100E+00		
.618000E+00	.555300E+00		
.662500E+00	.593500E+00		
.746400E+00	.664200E+00		
.775700E+00	.693100E+00