β-D Galactose Pentaacetate – Supercritical Carbon Dioxide as a Novel Binder - Binder Removal Agent for Metal Casting Operations: Phase Behavior of the Binary System

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With its remarkable solubility in high pressure carbon dioxide, β-D-Galactose Pentaacetate was chosen as a novel candidate binding compound for metal casting operations while removal of the binder was achieved with supercritical carbon dioxide. Removal of β-D-Galactose Pentaacetate from a bound sand plug was demonstrated at 15 MPa and 40 ^{o}C in a high-pressure variable volume sapphire cell. To understand the dissolution mechanism and determine the optimum processing conditions, phase behavior of β-D-Galactose Pentaacetate - supercritical carbon dioxide binary system has been studied by measuring the dew and bubble points of the binary system at constant temperatures between 35-50 ^{o}C. In this temperature range, solubilities up to 30 wt % β-D galactose pentaacetate were attained at pressures ranging from 9-16 MPa. The system shows a lower critical solution temperature system behavior, requiring higher pressure to reach single phase with increasing temperature. During the phase behavior experiments, the densities of the binary system at the phase boundary were determined. The binary system single phase viscosities were also measured with high pressure falling cylinder viscometer which showed that even though the binary system had high-liquid like densities the viscosity of the binary system was remarkably low, close to the pure carbon dioxide viscosities at those conditions.