

The Phase Behavior of the Binary System Carbon Dioxide + PCH-5

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Carbon dioxide capture from process streams by absorption in aqueous amine solutions is an expensive process mainly because of the high energy costs for the regeneration of the solvent. Because of this the search for alternative carbon dioxide capture processes is an important issue. In our laboratory we investigate the possibility of using liquid crystals as an alternative solvent for carbon dioxide capture making use of the difference in solubility of carbon dioxide in the liquid crystal phase and in the isotropic phase of the liquid crystalline material. In this work we have investigated the phase behavior of the system CO₂ + 4-(trans-4'pentylcyclohexyl)-benzonitril (PCH-5). PCH-5 shows a crystalline to nematic liquid crystal transition at 31 °C and a nematic liquid crystal to isotropic liquid transition at 54.6 °C. It is found that the solubility of CO₂ is higher in the isotropic liquid phase than in the nematic phase and that with increasing carbon dioxide concentration both the crystalline-nematic transition and the nematic-isotropic transition of the liquid crystalline material shift to lower temperature. The phase behavior of this binary system is further complicated by the occurrence of a liquid-liquid phase split at higher carbon dioxide concentrations.