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KUKERSITE OIL SHALE KEROGEN SOLVENT SWELLING IN BINARY MIXTURES

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Solvent swelling (volumetric expansion in solvents) is a useful technique for determining the solubility parameters of materials with cross-linked macromolecular structures and for characterizing solvent-macromolecule interactions. The swelling data utilized in suitable theoretical models may be used for calculating cross-link densities of networks and molecular weights between cross-links. The cross-link density of a macromolecular network directly determines its swellability. Non-covalent cross-links can be broken by specifically interacting solvents making the structure more swellable and penetrable by other solvents. The purpose of this research was to investigate the role of specific interactions (hydrogen bonds) in the swollen kerogen through use of binary solvent mixtures.

The oil shale kerogen sample used in this work was isolated from Kukersite oil shale by flotation technique and had a 91% organic matter content. The solvents used in the research were benzene, nitrobenzene, NMP (1-methyl-2-pyrrolidone), n-propanol, propylamine, pyridine and toluene.

The results of the research confirm the important role of specific interactions in swelling of kerogens by solvents. The highest swelling values for Kukersite kerogens are observed in high EDN solvents and these solvents determine the upper limit of swelling in mixtures of solvents. The results also show that the role of solvent solubility parameter is of secondary importance in determining swellability of such materials. The application of classical regular solution theory-based approaches for calculating the number average molecular weights between cross-links needs to be done in such a way that the underlying experiments assure the disruption of the non-covalent cross-links, or if that is not done, then the reported values are recognized to be influenced by these cross-links.