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Promotion of Catalytic Activity and Suppression of Deactivation by Solvent Addition in the Hydrotreating of Atmospheric Residue

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The effect of addition of several solvents on atmospheric residue (AR) hydrotreating was examined in the autoclave test. Higher hydrodesulfurization (HDS) activity was obtained by adding solvents in the order of H₂O > light cycle oil (LCO) > tetralin > none (base) > 1-MN > phenol, using the same volume of solvent. The amount of deposited coke on the catalyst was reduced with all solvents. Larger amounts of tetralin enhanced HDS activity, but tetralin was still inferior to water for the enhancement of HDS in the same molar amounts. The specific effects of H₂O were confirmed through the activity test. The amount of deposited coke on catalyst with tetralin was similar to that of H₂O. Enhancement of asphaltene desorption reduces coke formation on the catalyst whereas the hydrogenative conversion of solvents with sulfur species in AR may indicate competitive occupation on the active sites. Solvents were not only hydrogenated but also contributed to inhibition of HDS when remaining for long periods on the active sites. Consequently, the inhibition effects of the solvents were considered based on the conversion and evaluation results. H₂O enhances the desorption of asphaltene and desulfurized products from the catalyst compared with the other solvents. The remarkable effects of H₂O addition are due to remaining on the active sites for short periods, without inhibiting the HDS activity.

Keywords: [Atmospheric residue](#), [Hydrotreating](#), [Water addition](#), [Hydrodesulfurization](#),



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