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Modeling the Aqueous-Phase Copper Ion-Exchange Behavior onto SSZ-13 Zeolites

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ABSTRACT

Copper-exchanged zeolites are utilized as catalysts for the selective catalytic reduction of nitrogen oxides, which are atmospheric pollutants found in diesel engine exhaust. The total amount of copper ions and the types of copper species (Cu(II) or Cu(II)OH) exchanged onto a zeolite can be varied. Copper is exchanged onto SSZ-13 (an aluminosilicate zeolite with the chabazite topology) during a process known as aqueous ion exchange, where the zeolite is mixed in a copper-containing solution. The distribution of copper on SSZ-13 is influenced by exchange conditions, including the molarity, temperature, and pH of the copper solution. The effect of exchange conditions on the amount and type of copper exchanged onto SSZ-13 has not been thoroughly investigated. In order to study these effects, ion exchange experiments were performed with solutions containing different copper concentrations and pHs. The copper loading (wt%) of each SSZ-13 sample was determined by atomic absorption spectroscopy (AAS). Data from AAS shows that SSZ-13 samples exchanged in solutions with higher copper molarities have higher copper loadings. Further exchanges are being done to test the effects of pH on the amount and type of copper species exchanged onto SSZ-13 through characterization by AAS and temperature programmed desorption (TPD). Using the collected data, a model will be developed to predict the amount and distribution of copper on SSZ-13 based on the exchange conditions.

KEYWORDS

Aqueous ion exchange, copper speciation, SSZ-13, pH control