Effect of hydrothermal aging on local environment of active site in CuSSZ13

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CuSSZ13 has been regarded as the most proven Urea/SCR catalyst for reducing NOx from diesel engine, mainly due to its excellent low-temperature activity and strong thermal stability. However, despite extensive efforts to understand the characteristics of CuSSZ13, the local environment of the Cu^{2+} ions on the catalyst surface and the reason behind its robust thermal stability have not been fully elucidated yet. In the present study, the catalytic activity and properties of a series of CuSSZ13 catalysts w.r.t. the Cu content and Si/Al ratio have been investigated before and after aging, to understand their hydrothermal stability. The thermal deactivation of CuSSZ13 becomes more severe with increasing Cu content and/or Si/Al ratio. Based upon the ESR studies, the D6R sites are exchanged first by Cu^{2+} ions upto their accommodation capacity, followed by the occupation of the CHA sites with increasing Cu content and Si/Al ratio. The origin of the severe deactivation of CuSSZ13 upon aging with the high Cu content and Si/Al ratio appeared to be the facile agglomeration of the Cu^{2+} ion in CHA due to its less stable nature, leading to the formation of CuOx clusters whose growth may destroy the crystal structure of SSZ13.