

XAS Study on the Removal of CMP Nanoparticles with Zinc Ions

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The SiO_2 nanoparticle in the CMP wastewater has been a problem for most conventional particle control technology due to its nanoscale size (Lai and Lin, 2004; Lin and Yang, 2004; Yang et al., 2003). Figure 1 shows the SEM morphology of particles dried at 105 °C from the CMP wastewater. The shape of SiO_2 particles is spherical and uniform. Moreover, the mean particle size is approximately 90 nm so that they cannot be removed by direct filtration. In this study we attempt to reduce the turbidity caused by nanoparticles in the wastewater collected from a high-tech plant by way of adding proper amount of Zn salt. According to the adsorption and charge neutralization principle to agglomerate the SiO_2 nanoparticles, the turbidity of CMP wastewater can be reduced to 11.8 NTU. After the agglomeration of the nanoparticles with the countercharged metal ions, conventional methods of wastewater treatment techniques can then be used to remove the agglomerates.

X-ray absorption spectroscopy was used to investigate zinc species change in the considerable deposits of SiO_2 nanoparticles. As indicated in Figure 2, results from XANES fitting of the sample indicate that zinc in the solid phase contains about 87 % zinc sulfate, and 13 % $\text{Zn}(\text{OH})_2$. It is noted that charge neutralization occurs between the added zinc ions and the nanoparticles. Moreover, the neutralization can destroy the stability of the suspended colloids and achieve the goal of agglomeration.

References

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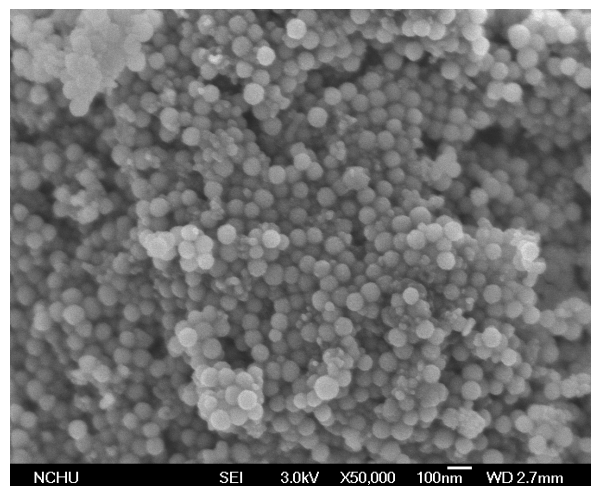


Figure 1. the SEM morphology of particles dried at 105 °C from the CMP wastewater.

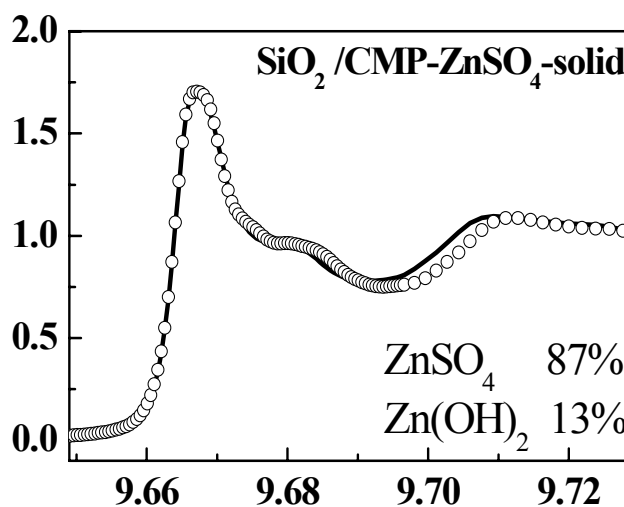


Figure 2. XANES fitting spectrum of zinc-containing nanoparticles (-: experimental curve; ° : fitted curve).