

Catalytic conversion of SO₂ to SO₃ by new nanocatalyst of vanadium oxide

Abstract

Vanadium(V) pentoxide (V₂O₅) is used as a catalyst in the conversion of SO₂ to SO₃ in the sulfuric acid plant at the National Iranian Copper Industries Company (NICIC), Sarcheshmeh Copper Complex, Iran. The input SO₂ gas is supplied from the stack of roasting and bessemerization units. In this project, several nanocatalysts of V₂O₅ were synthesized from two V(IV) precursors, [VO(SO₄)(OH₂)]·2H₂O and [VO(ox)(OH₂)]. Two precursor complexes, one commercial catalyst from BASF, and the prepared nanocatalysts were fully characterized by FT-IR, TGA, DTA, XRF, and XRD methods. The FE-SEM images show that the nanocatalysts have a particle size of 25 nm. In addition, the catalytic activity of all prepared nanocatalysts and the commercial catalyst (BASF catalyst) were determined using catatest unit. The results show that the nanocatalysts can convert SO₂ to SO₃ with a more than 90 percent yields and their efficiency is more than the commercial V₂O₅ catalyst (BASF catalyst). Finally, a proper mechanism was proposed for the catalytic conversion of SO₂ to SO₃ by computational methods.