

Use of Waste Active Sludge for Reducing Fe₂O₃

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Abstract : The work of water treatment plants from various sources of pollution includes a biological treatment stage using activated sludge. Due to the large volume of toxic activated sludge waste (WAS) generated and soil contamination during its storage, WAS disposal technologies are being continuously developed. The most common is the carbonization of WAS. The carbonization products are various forms of ordered and disordered carbon material having different reactivity. The aim of this work was to study the reduction process of Fe₂O₃ mixed with activated sludge waste (WAS). It could be assumed that the simultaneous action of the WAS thermal decomposition process, accompanied by the formation of reactive nano-carbon, with carbothermal reduction of the Fe₂O₃, will permit intensify reduction of metal oxide up to stage of metal and iron carbide formation. The studies showed that the temperature treatment in the region of (800-1000) °C for 1 hour under conditions of oxygen deficiency is accompanied by the occurrence of reactions: Fe₂O₃ → Fe₃O₄ → FeO → Fe, which are typical for the metallurgical process of iron smelting, but less energy-intensive. Depending on the ratio of the WAS - Fe₂O₃ components and the temperature-time regime of reduction of iron oxide, it is possible to distinguish the stages of the predominant formation of ferromagnetic compounds, cast iron, and iron carbide. The results indicated the promise of using WAS as a metals oxide reducing agent and obtaining of ceramic-based on metal carbides.

Keywords : carbothermal reduction, Fe₂O₃, Fe_xO_y-C, waste activated sludge

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