Nanochemistry and Nanobiotechnology

Chemical transformations of nanoparticles during mechanochemical alkaline dispersion of sponge iron

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Results of iron ore nanocarbon recovery in obtaining of sponge iron and its subsequent alkaline iron cleaning brought to conclusion that such cleaning is the most effective way to separate metal from non-metallic impurities [1]. The importance of nanochemical reactions was shown, accompanying the cleaning process, in justifying the optimal method of metal grinding, containing impurities of wustite nanoparticles (FeO), carbon, cementite (Fe_3C), and microparticles of silicates, phosphates, arsenates, sulfides, etc. The cleaning process is accompanied by major nanochemical reactions:

$$FeSiO_3 + 2NaOH \rightarrow Fe(OH)_2 + Na_2SiO_3;\ nNa_2SiO_3 + nH_2O \text{ €} \quad 2nNa^+ + n\underbrace{\left[(HO)_3 \equiv Si - O^-\right]}_{\text{(nanocluster)}}$$

$$mineral \equiv (Si - OH)_n + n\left[(HO)_3 \equiv Si - O^-\right] \rightarrow mineral\underbrace{\left[\equiv Si - O - Si \equiv (OH)_3\right]_n}_{\text{(surface nanocluster)}} + nOH^-$$

;

$$4nFeO_{NANO} + 2nH_2O + nO_2 \rightarrow 4n(\alpha - FeOOH)_{NANO};\ 3nFeO + nH_2O \rightarrow nFe_3O_4 + nH_2;$$

$$nC_{NANO} + nH_2O + nO_2 + nFe \rightarrow nFeCO_{3(NANO)} + nH_2;\ nFe_3C_{NANO} + 3nO_2 + nH_2O \rightarrow 2nFeOOH$$

Nanoclusters and chemicals (formed during these processes) are being absorbed in contact zones, and promote separation of mineral admixtures from metal under mechanical impact or abrasive loads. Mineral admixtures have been passed into a dispersion medium in the form of individual particles [2, 3].

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2. Nanoscience: Colloidal and Interfacial Aspects. – London-New York : CRC Press Taylor and Francis Group.-2010.–P.523-568.
3. *Oleinyk V.A, Pan'ko A.V., M.O. Ilyashov M.O., Kovzun. I.G., Protsenko I.T.* Enrichment of Iron Ores with Use of Nanomaterials Based on the Alkaline Silicates // Metallofizika I Noveishie Tekhnologii. – 2011.-**33**.-P.587-594.