Title (en)

PREPARATION OF METAL OXIDE POWDERS USING ACTIVATED BALL MILLING

Title (de)

HERSTELLUNG VON METALLOXIDPULVERN MITTELS AKTIVER KUGELMÜHLE

Title (fr)

PREPARATION DE POUDRES D'OXYDE METALLIQUE PAR BROYAGE A BILLES ACTIVE

Publication

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Application

**EP 95933977 A 19951004**

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Abstract (en)

[origin: WO9610539A1] Total phase transformation of hematite to magnetite was accomplished at room temperature by wet magnetomechanical activation of hematite. Low energy mechanical activation of the oxide surface is sufficient to effect the transformation. Oxygen bonds on a alpha - Fe2O3 oxide surface are apparently broken during the mechanical activation process and oxygen is released (removed) to the dispersing polar liquid. The oxygen pressure during the process as well as the nature of the dispering liquid have a critical influence on successful and fast phase transformation. Thus, all preparation performed in air, dry conditions or with nonpolar or saturated hydrocarbons (benzene, anthracene) show that the process of hematite reduction is non existent or very slow. Normal air pressure and/or application of hydrocarbons suppress the transformation. The effects of prolonged milling in air and vacuum on BaFe12O19 ionic crystal structure and particle morphology have been analysed. X-ray diffraction, scanning electron microscopy and thermal analysis experiments show, that for vacuum milled material, the ordered structure transforms progressively into a stable disordered nanocrystalline phase. For air milled samples, apart from a structural transformation, chemical decomposition was found. Application of heat treatment restores perfect Ba-ferrite crystal structure with the particle remaining in the submicron size range. With structural changes during annealing, the magnetic properties were altered. Radically different hysteresis behaviour was obtained for powders annealed at 1273 K. The value of volume magnetisation 4 pi Ms = 335.4 - 347.2 kA/m is near the value for premilled ferrite powder (10 % lower), but measured coercivity value Hc = 393.9 - 445.6 kA/m was improved quite remarkably by a factor of 6 due to the fine crystalline grain structure.

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