Transformations in aluminum oxyhydroxide under powerful short-pulse microwave radiation

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Thermal effects in non-irradiated and in irradiated with MWs samples of Al oxyhydroxide

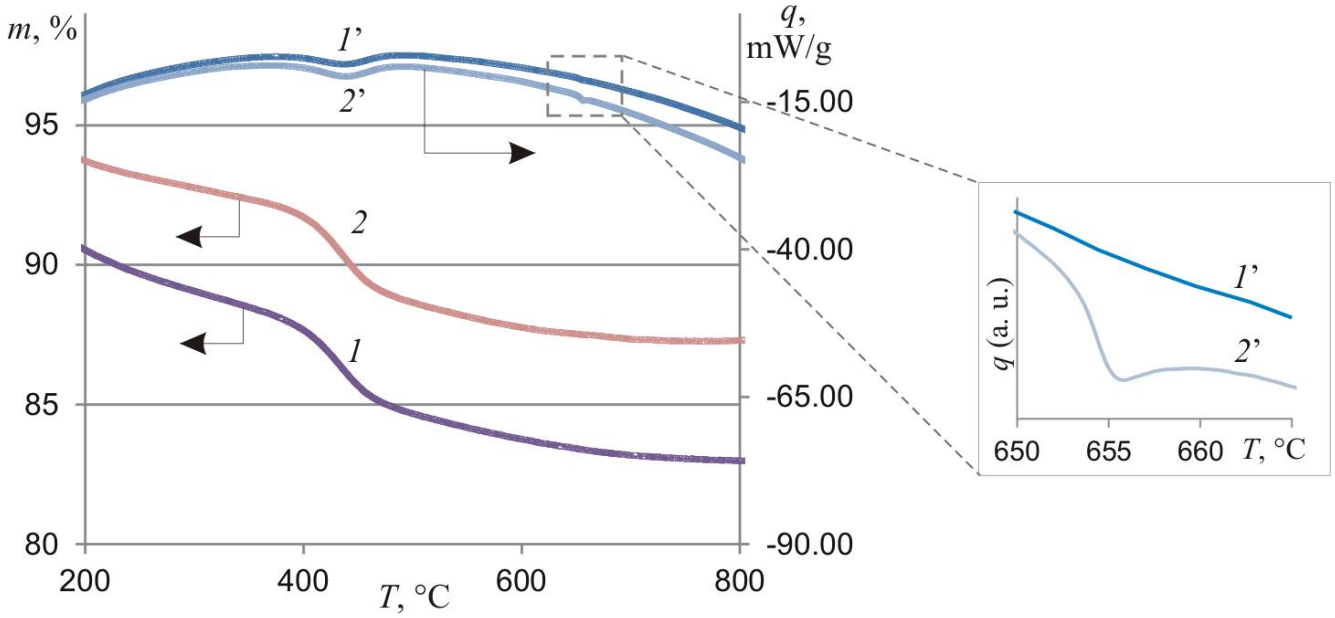

Figure 1. The TG (*1*,*2*) and DTA (*1'*,*2'*) curves of linear heating of the Al oxyhydroxide samples before (*1*, *1'*) and after (*2*, *2'*) exposure to the powerful short-pulse microwave radiation; in the insert on the right, the parts of DTA-curves corresponding to the temperature area of Al melting are shown

At linear heating of the irradiated sample, an endo-effect at ≈656 °C is observed in the DTA-curves, which is caused by melting of metal aluminum. Such an effect is absent in the control experiments with the non-irradiated sample (Fig. 1, curves *1'* and *2'*). Slightly decreased melting temperature, in comparison with the standard one (660 °C), might be connected with the small sizes of Al fragments (clusters, nanoparticles) formed [8].

Phase composition of the irradiated samples

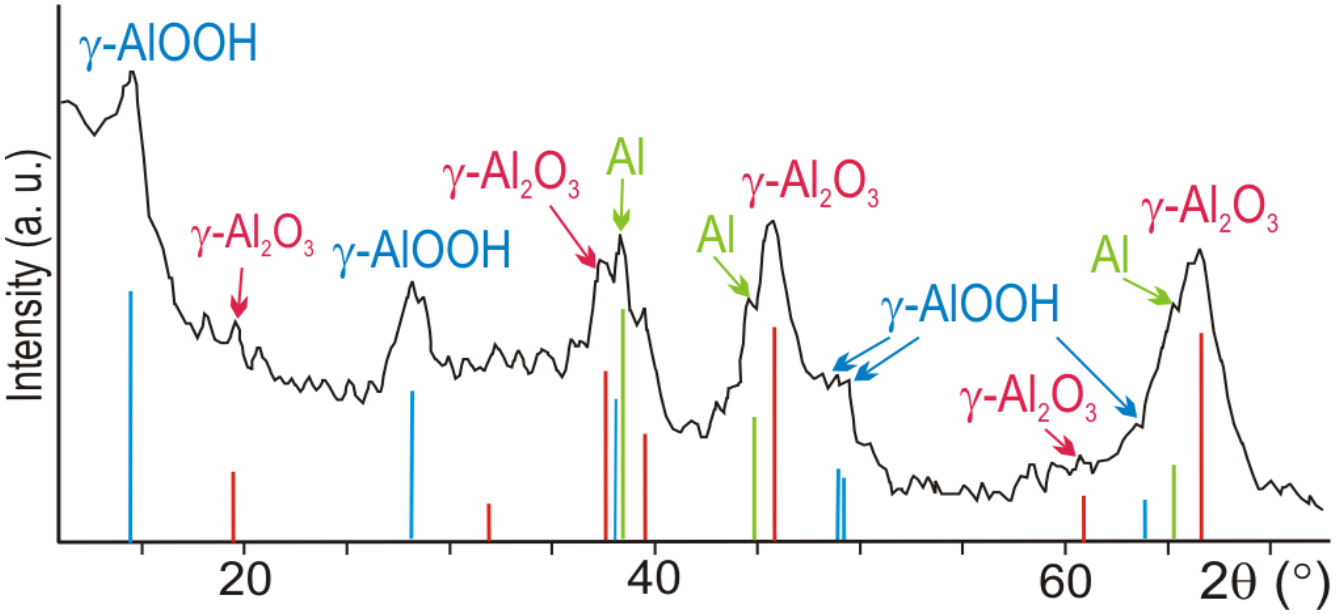

Figure 2. XRD-pattern of Al oxyhydroxide exposed to microwave radiation for 3 min under ambient conditions

An average content of the metal in the treated samples amounted to ~1.5 wt. % (Fig. 1, curve *2*'). This value is in good agreement with the additional metal content in the irradiated Al nanopowders determined by the volumetric method. The presence of the metal Al traces in the irradiated samples was also confirmed by X-ray diffraction (Fig. 2).

Structure transformation in Al oxyhydroxide under powerful microwave irradiation

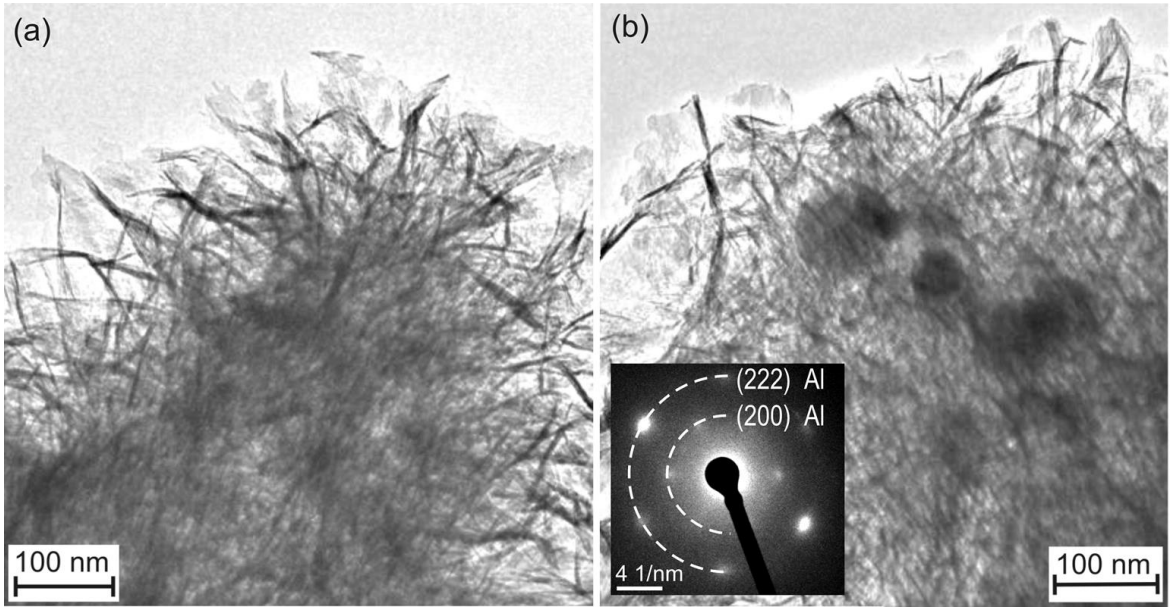

Figure 3. TEM micrographs of Al oxyhydroxide before (a) and after (b) microwave irradiation; an electron diffraction pattern is shown in the insert

It follows from the TEM observations that spheroidal dense structures smaller than 100 nm were formed within the oxyhydroxide matrix after microwave irradiation (Fig. 3). The positions of reflexes on the electron diffraction patterns correspond to the lattice characteristics of metal Al (Fig. 3, b).