

INFLUENCE OF LOW-ENERGY MECHANOACTIVATION ON THE PHASE COMPOSITION AND MICROSTRUCTURE OF THE 3Ni-AL INTERMETALLIDE-FORMING SYSTEM

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The mechanical method of activating chemical transformations is used to stimulate various solid-phase reactions [1]. Mechanochemical synthesis is also considered as one of the possible ways of "dry" technological processes in which the reaction is carried out without the use of solvents, thereby achieving a significant gain both in the cost of the process and in solving many environmental problems [2].

At the same time, despite its proven effectiveness, machining in high-energy crushing devices often requires more careful selection of experimental conditions. Otherwise, it can lead to the formation of intermediate phases and contamination, which will complicate the subsequent synthesis of the product outside the mill [3]. In this paper, a variant of low-energy mechanical activation (LEMA) of a 3Ni+Al powder mixture [4] and its effect on the structure and elemental phase composition of the mechanocomposite particles formed from the components of the mixture are considered. The time of low-energy machining of the powder mixture varied between 0 and 30 hours.

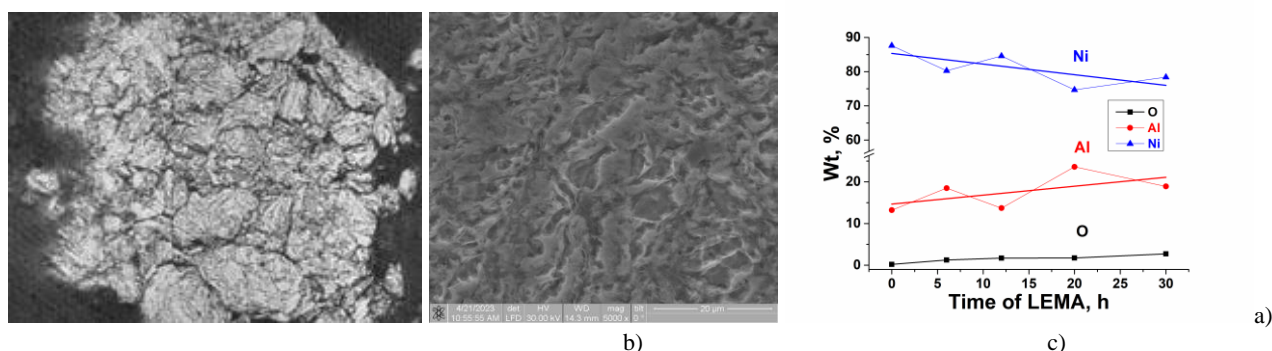


Figure 1. Microstructure of the cross-section of the agglomerate of the 3Ni+Al powder mixture after 30 hours of LEMA: optical image (a), SEM image (b) and elemental composition of the cross-section of mechanocomposites as a function of LEMA time (c).

It was revealed that in mild conditions of LEMA, loose agglomerates consisting of a nickel matrix with aluminum inclusions are formed in the mixture (a). Microanalysis showed that after 6 hours of LEMA, areas with 100% nickel or aluminum content are not detected. Here we can only talk about areas with a predominant content of one or another component. At the same time, after 30 h LEMA, the internal structure of the agglomerate looks more smeared (torn, fibrous), almost no separate clearly formed layers are visible (b). The distribution of the elemental composition in the section of the mechanocomposite indicates a slight increase in the mass concentration of oxygen in the mixture with an increase in the LEMA time to 2.86 wt.% (s). At the same time, the mass concentration of aluminum in the section increases slightly (by 5.71 wt.%) due to a decrease of about the same amount (7.85 weight.%) nickel concentration.

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