POLITECHNIKA ŚLĄSKA

WYDZIAŁ INŻYNIERII MATERIAŁOWEJ

KATEDA METALURGII I RECYKLINGU (RM2)

TOMASZ WOJTAL

OKREŚLENIE SZYBKOŚCI REDUKCJI TLENKÓW CYNY MIESZANKAMI GAZ OBOJĘTNY - WODÓR

PRACA

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SUMMARY

Considering chemical nature, hydrogen was considered too dangerous for years, to use it in the high-temperature industry. Nowadays, however, this assumption is being abandoned. The metallurgical industry has started to notice the positive aspects of hydrogen technologies. Hydrogen has become an object of interest as an ecological and easily renewable raw material. It is an alternative to environmentally unfriendly technologies that use materials such as solid carbon or gaseous CO and CH_4, which generate large amounts of greenhouse gases (mainly CO_2).

New technological solutions allow metal oxide reduction processes to be carried out in a safe and controlled manner using hydrogen. This gas is characterized by high penetrating ability, which allows much better contact with the solid, oxide phase than in the case of solid reducers. This allows for high efficiency of the entire process. An additional advantage of these technologies is that they are environmentally friendly and that they can significantly intensify the production process. It should also be mentioned that hydrogen energy is considered a type of clean and regenerative energy, with zero emissions of carbon and its compounds, and this is becoming the direction of development of the global energy industry.

The paper presents the results of research on the reduction of tin oxide (SnO) using molecular hydrogen (H_2), supplied as a mixture with an inert gas such as argon (Ar). The hydrogen content in the mixtures used was 1 – 10% vol.H_2. The reduction process was carried out in the temperature range of 773 – 873K. The tests were carried out using the thermogravimetric (TG) method using a NETZSCH thermobalance model STA 449F3. Based on the data obtained, a kinetic analysis of the process was performed.

The work showed that with an increase in temperature, in the analyzed range, the reaction rate increases, and the obtained degree of SnO reduction varies from 45,51 to 100%. Stabilization of changes in the mass of the tested sample was achieved after a time ranging from 25 minutes for a temperature of 773K to 15 minutes for a temperature of 873K.

Based on the data obtained, it was also shown that the hydrogen content in the reducing mixture is significant only when using the temperature range of 773K - 833K, where the degree of SnO reduction for the use of 1% vol. H_2 was 45,51%, and for 10% vol. H_2 was 59,91%. The use of higher temperatures regardless of the mixture used allowed to achieve 100% SnO reduction.