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研究速報・Short Communication

Inhibition of Anatase-Rutile Transformation due to Nb₂O₅ Addition

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Nb₂O₅ の添加によるアナターゼ-ルチル転移の抑制

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The anatase-rutile transformation process has widely been investigated. The transformation takes place over a wide range of temperatures (300°~1000°C) depending on the factors determining the rate of the process. As the factors, the composition of starting materials¹⁾, the amount of content and the type of additives^{1), 2)}, atmospheres³⁾, the contact area of the powders⁴⁾, etc. have been investigated. The mechanism has not been fully clarified yet, in these papers.

Through critical examination upon the results of the papers, the present authors propose that behaviors of lattice defects and contacts between anatase particles might be the most important ones among the various factors. Most of the additives investigated so far, were known to accelerate the transformation. Adding CuO, MnO₂, CoO, NiO¹⁾ or Fe₂O₃²⁾ to TiO₂ may well be responsible for

enhancement of lattice defects of Ti interstitials or O vacancies. One of the exceptions was the inhibitory effect of SiO₂ addition⁴⁾. The SiO₂ covered the surface of anatase particles, which separated the contact between particles, since the reaction between SiO₂ and TiO₂ did not take place under the conditions surveyed. From these findings on the effects of additives one might consider that if additives did react with titania the transformation was accelerated while the transformation was inhibited if the reaction did not take place⁴⁾. Adding Nb₂O₅ to TiO₂, however, is known to suppress the formation of lattice defects of Ti interstitials or O vacancies in titania^{5), 6)}.

In the present communication an inhibitory effect of Nb₂O₅ addition to TiO₂ on the anatase-rutile transformation was investigated.

Anatase powders (Fuji Titanium Co., 99.98 % purity) were mixed with 2 mol%Nb₂O₅ in

Fig. 1. The percentages of converted anatase into rutile vs. the time of calcination at 870°C in “pure” anatase (a) and Nb₂O₅-mixed anatase (b).

ethanol and dried. The samples were put on a silica glass and heated in an electric furnace at given temperatures (600°~900°C). After appropriate calcination time the samples were air-quenched and the anatase-rutile transformation was analyzed by measuring of the respective X-ray diffraction peak heights.

Percentages of conversion of anatase into rutile were plotted vs. the time of calcination at 870°C for samples of “pure” anatase (a)

and Nb₂O₅-mixed anatase (b), respectively in **Fig. 1**. The transformation rate was calculated according to the empirical equation⁷⁾,

$$f_R = \left(1 - \frac{1}{1 + 1.26 \frac{I_R}{I_A}} \right) \times 100 \quad (1)$$

where f_R is weight percentage of rutile, I_R peak intensity of rutile ($2\theta=27.46^\circ$, Cu K α) and I_A peak intensity of anatase ($2\theta=25.35^\circ$, Cu K α), respectively.

From the above results, it was found that the anatase-rutile transformation was suppressed by an addition of Nb₂O₅ which reacted with TiO₂.

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訂正

田中英彦, 長谷川安利, 猪股吉三著 “Si₂ON₂-Y₂O₃-Al₂O₃ 3成分系の 1400°C における相関係” 窯協, **86**, [8] 365-68 (1978) につきまして著者より右記のような訂正の申し出がありました。

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