PLASTIC DEFORMATION AND NONSTOECHIOMETRY IN RUTILE TiO$_2$

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Abstract

The aim of this work is to study plastic deformation of sub-stoechiometric rutile TiO$_{2-x}$ (x Є [0 ; 34.10^{-4}] and at a temperature of 1050°C). For this purpose, a rig allowing deformation under compression at high temperature and controlled reducing atmosphere, has been used. In order to preserve to ambiant temperature, the obtained samples microstructure at high temperature ,a soalcing system under secondary vacuum, was set up. Observation under transmission electronic microscope of   TiO$_{2-x}$ soalced samples, has confirmed   the efficiency of our soalcing system and that these structures can be analysed as solid solution of intrinsic ponctual defects. Precipitates of Fe$_2$Ti$_{n-2}$0$_{2n-2}$ type in the shape of plates perpendicular to [1 0 0] directions and appearing at low temperature could be observed in these compounds.

Plastic deformation of TiO$_{2-x}$ monocrystals have given :

- For a compression with compression axis at 45° from the [001] direction : it has been noted an important hardening for increasing x values. In this case the deformation is controlled by the majority specific defect interstitial titanium. The actived slip system is of $\{101\} < \bar{1}01>$ type.
- For a compression according to [111] direction: it has been observed an important softening of sub-stoechiometric rutile compared to TiO$_2$ .The actived slip system being of $\{110\}$ <001> type.

Observation under transmission electronic microscope of reduced then deformed samples has shown plans defects presence of $\{132\}$ type. These defects appears during the cooling of the sample and are supported by the presence of network dislocations introduced by plastic deformation .

Keywords: rutile, deformation, sub-stoechiometrie, defects.

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