AEC-NASA TECH BRIEF

Grain-Boundary Migration in KCl Bicrystals

Argonne National Laboratory has made a study of the migration of grain boundaries in potassium chloride bicrystals and developed a technique for determining the mobility of these boundaries.

Many physical properties of polycrystalline materials are controlled by microstructure. In the control of microstructure, grain-boundary migration plays a leading role. The purpose of this work was to study the effect of temperature and the crystallographic misorientation across a grain boundary on the interface migration characteristics in a simple ceramic system. Potassium chloride was selected because bicrystals of controlled misorientation can easily be produced, and the diffusion and defect structure have been extensively investigated.

In the study, the boundary migration in melt-grown bicrystals of KCl containing pure twist boundaries was investigated. The experiments involve the use of bicrystal specimens in the shape of right-triangular prisms with the boundary parallel to one side. When the boundary attempts to equilibrate with the sides, a curvature of the boundary—and thus a driving force for migration—is introduced.

In the KCl bicrystals, no clear-cut effect of misorientation angle on the mobility could be observed over the limited range of angles studied. However, an unexpectedly high activation energy, 4.0–6.0eV, was found for boundary migration. This may be related to the presence of impurities in the specimens.

Measurement of intrinsic boundary mobility is possible with this system if crystals of sufficient purity are available. However, preparation of shaped bicrystal specimens of very high purity is extremely difficult.

Notes:

1. A report, "Grain-Boundary Migration in Potassium Chloride Bicrystals," by C. F. Gibbon, ANL-7232, August 1966, Argonne National Laboratory, Argonne, Illinois, is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151; price: $3.00; microfiche copies, $0.65.
2. The report includes the theory, previous studies, experimental procedure, general features of migrating boundaries, and mobility measurements.
3. This information may be of interest to researchers working with grain boundary problems in ceramics.
4. Inquiries concerning this innovation may be directed to:

Office of Industrial Cooperation
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439
Reference: B68-10455

Source: C. F. Gibbon
Metallurgy Division
Argonne National Laboratory
(ARG-10181)

Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
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9800 South Cass Avenue
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