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This Week's Citation Classic

Gleiter H, Hornbogen E & Bäro G. Der Mechanismus des Korngrenzengleitens. [The mechanism of grain boundary glide.] *Acta Metallurgica* 16:1053-67, 1968. [Inst. Metallphysik, Univ. Göttingen, Federal Republic of Germany]

This paper described the direct observations of dislocations (termed 'grain boundary dislocations') in grain boundaries by transmission electron microscopy. An atomistic model of these new types of dislocations was proposed. Their significance for the boundary structure and understanding of certain grain boundary properties (sliding, generation of lattice dislocations) was pointed out. [The *SCI*® indicates that this paper has been cited over 85 times since 1968.]

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"The work leading to this paper was done more than ten years ago at the University of Göttingen. Günther Bäro, who was then a graduate student (he is now with the Brown-Boveri Company as a materials scientist), set out to study the process of the sliding of grain boundaries on an atomistic scale using the method of transmission electron microscopy of thin films. Transmission electron microscopy of thin films was known at that time to be a powerful tool for investigating deformation processes in crystals. Although in hindsight the application of electron microscopy to study the atomistic mechanisms and defects involved in the sliding process of grain boundaries seems the logical and almost obvious thing to do, its application to the problem was more a speculation, rather than clever a *priori* reasoning.

"By applying this method, it was found that, in interfaces, types of defects (dislocations) may exist similar to those which have been studied in crystal lattices in great detail since electron microscopy was applied to problems of this type. The significance of the dislocations discovered in interfaces (and termed 'grain boundary dislocations') was obvious in view *of* the great significance of lattice dislocations for the understanding of many properties of crystals. The analogy between the grain boundary dislocations observed and lattice dislocations led to the proposal of an atomistic model of grain boundary dislocations and dislocation mechanisms for the sliding of grain boundaries as well as the role of interfaces as dislocation sources. This model and the mechanisms were in many respects similar to the well-known dislocation models and mechanisms for crystal lattices.

"Why has this article been cited relatively often? The following factor appears most important to me. The observations helped to show how electron microscopy can be applied to study the structure and behaviour of interfaces. I suspect (although I have no proof) that many electron microscopists had seen the effects we reported a long time before us. Apparently, the most important step in our work was to become aware of their existence, visibility, and significance.

"This view is supported by the many papers that were published in the subsequent years following this line of investigation.[1,2] A considerable improvement of our present understanding of interfaces has resulted from these investigations and it seems likely that the application of high resolution electron microscopy may yield new, exciting results in the near future.

"Finally, it may be mentioned that this work was part of a research activity on grain boundaries and interphases as a result of which I was awarded the Masing Prize of the German Society for Metals (Deutsche Gesellschaft fur Metallkunde) in 1972."

1. **Chalmers B & Gleiter H.** High angle grain boundaries in metals. *Progr. Mater. Sci.* 16:179-212. 1971.
2. **Loberg B & Norden H.** High resolution microscopy of grain boundary structure. (Chadwick G A & Smith D A. eds.) Grain *boundary structure and properties.* London: Academic Press. 1976. p. 1-42.