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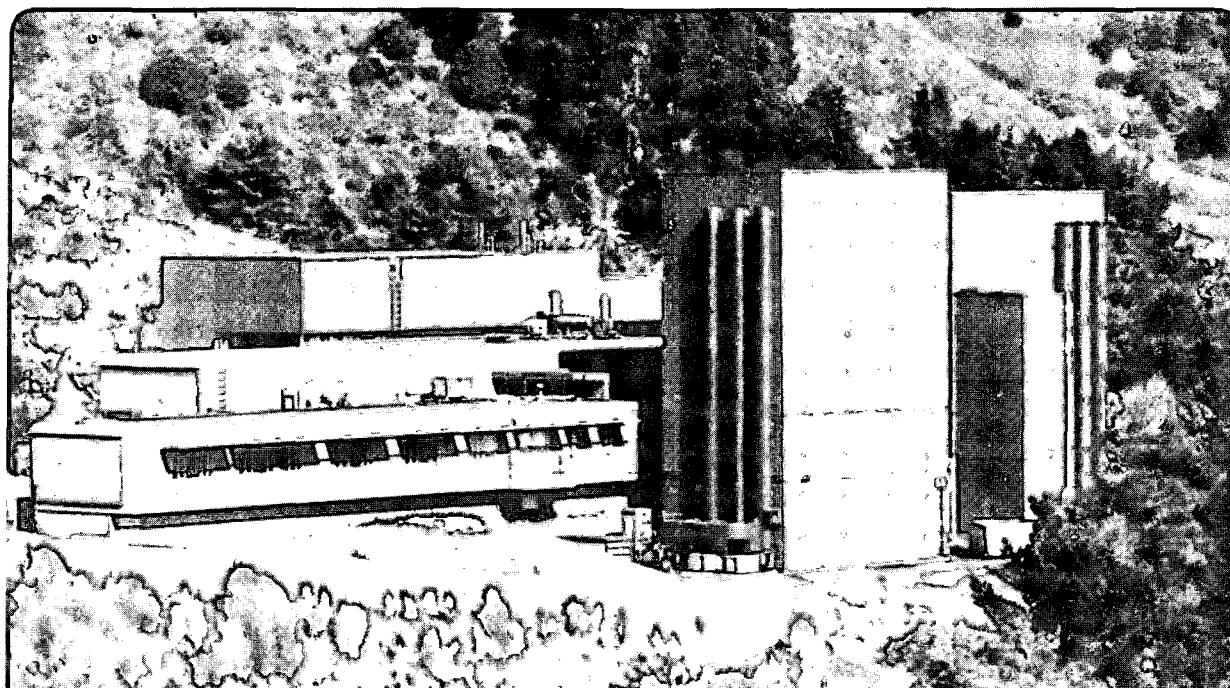
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**TEM Analysis of Enclosed
Crystal Microstructures and Interfaces**

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TEM Analysis of Enclosed Crystal Microstructures and Interfaces

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The study of enclosed crystal shapes in relation to their interface structure is an area of phase transformations rich in new and interesting phenomena. It is shown that transmission electron microscopy (TEM) can make an important contribution to the understanding and control of materials properties through the experimental study of these phenomena by conventional, analytical, high resolution, diffraction and dynamic in-situ techniques.

There is a close connection between the morphology, interface structure, defect substructure, and formation mechanism of precipitates in a solid matrix. This relationship is explored for some model alloy systems with representative examples of plate, needle-and lath-shaped precipitates. The mechanism for accommodating the changes in crystal structure and atomic volume that accompany precipitation is reflected in the details of the interface structure. Thus, characterization of the fine structure in an interface provides important information on phase transformation mechanisms. Complementary to static observations, dynamic in-situ experiments by high voltage electron microscopy show that germanium precipitates in an aluminum matrix can be transformed between a strongly faceted, anisotropic shape and a rounded, isotropic shape. This change of shape is a faceting/roughening transformation analogous to that found for free surfaces and solid/liquid interfaces. The relation between this transformation and the ledge growth mechanism is investigated conceptually in terms of crystallography, and experimentally by TEM analysis of the atomic interface structure. Similar observations for enclosed grains in thin films of aluminum with the continuous bicrystal structure are documented by quantitative high voltage and high resolution electron microscopy.

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