

Colloquium

Study of Phase Transformations in Alloys and Structure of Disordered Solids by Transmission Electron Microscopy

G K Dey

BARC, Mumbai

Alloys show various phase transformations under thermal activation, under pressure and under irradiation. Study of these transformations creates a knowledge bank which is extremely useful in correlating the structure of these alloys with their mechanical properties. During fabrication of alloy components, these undergo several transformations because of the heating and cooling cycles adopted and the aforementioned knowledge bank helps in avoiding undesirable phases. This knowledge bank is also useful for predicting the life of the components during use. The focus of the first part of the presentation is on giving a flavour of the wide range of phase transformations studied in Zr based alloys using primarily transmission electron microscopy (TEM). Examples of transformations involving shear, diffusional transformation and hybrid transformations have been included in this part.

The structure of disordered solids like glasses has been an enigma for long though these are ubiquitous because unlike crystals or quasi-crystals these do not have translation order or rotational symmetry. The second part of the presentation showcases results of investigations on all aspects of structure of disordered solids and gives a strategy for deciphering the complete structure of such materials by taking metallic glass as an example. The three different components of these structures viz. short-range order (SRO), medium range order (MRO) and the free volume or open space have been determined by a combination of techniques along with first principle molecular dynamic simulations. These techniques together have not only given a very good measure of the three attributes of the structure, but also the correlation between these three thereby giving a complete understanding of the structure of these disordered solids which was not possible earlier. The role of some of the latest TEM based techniques in these investigations forms the subject matter of this part of the presentation.

Monday, Jul 31st 2023

4:00 PM (Tea/Coffee at 03:45 PM)

Auditorium, TIFR-H