

## RECENT DEVELOPMENTS IN QUANTITATIVE FRACTOGRAPHY

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Conventional stereological procedures are based on flat section planes through a material, or on flat projected images obtained by transmission through a thin foil and are well-known. The situation is not as well developed in the case of nonplanar fracture surfaces. More information is needed to supplement the data obtainable from the flat SEM image. Two approaches to this problem have been found useful. The photogrammetric method performs a point-by-point registration over the fracture surface. It has the advantage of being nondestructive. Another method of analysis is based on profiles obtained from vertical sections through the fracture surface. Sampling is more extensive and the underlying microstructure is revealed with respect to the fracture surface. However, the method is destructive.

The profile can be analyzed quantitatively in several ways, chief among which are the coordinates along the profile, the angular distribution of linear elements that comprise the profile, the total length of the irregular profile, etc. Several nondimensional profile parameters of interest have emerged in the analysis of these irregular planar curves. Chief among these is the profile roughness parameter  $R_L$  (defined by Gurland as the true profile length divided by the projected length). This profile parameter is of fundamental significance in relationship involving the fracture surface. Several parametric relationships have been proposed between  $R_L$  and its counterpart in sample space,  $R_S$  (defined as the true fracture surface area divided by its projected area). Another method for determining  $R_S$  is based on the general geometrical relationship between the angular distribution of linear elements along a profile and the angular distribution of surface elements comprising the fracture surface. We have shown that the angular distribution method gives value of  $R_S$  comparable to those obtained by the parametric equation method. The results of the calculation of the true surface area by the various methods have been checked by the use of a computer-simulated fracture surface (CSFS).

It is felt that considerable progress has been achieved in this difficult area. Our final objective, however, is to devise a practical procedure that determines the surface roughness, efficiently and accurately, and provides the three-dimensional parameters needed to complete the information that can be extracted from the SEM photomicrograph.