

1.1: Introduction

In most technological applications, metals are used either in a finely divided form (e.g. supported metal catalysts) or in a massive, polycrystalline form (e.g. electrodes, mechanical fabrications). At the microscopic level, most materials, with the notable exception of a few truly amorphous specimens, can be considered as a collection or aggregate of single crystal crystallites. The surface chemistry of the material as a whole is therefore crucially dependent upon the nature and type of surfaces exposed on these crystallites. *In principle*, therefore, we can understand the surface properties of any material if we

1. (This approach assumes that we can neglect the possible influence of crystal defects and solid state interfaces on the surface chemistry). It is therefore vitally important that we can independently study different, well-defined surfaces. The most commonly employed technique, is to prepare macroscopic (i.e. size \sim cm) single crystals of metals and then to deliberately cut-them in a way which exposes a large area of the specific surface of interest.

Most metals only exist in one bulk structural form - the most common metallic crystal structures being:

- For each of these crystal systems, there are in principle an infinite number of possible surfaces which can be exposed. In practice, however, only a limited number of planes (predominantly the so-called "low-index" surfaces) are found to exist in any significant amount and we can concentrate our attention on these surfaces. Furthermore, it is possible to predict the ideal atomic arrangement at a given surface of a particular metal by considering how the bulk structure is intersected by the surface. Firstly, however, we need to look in detail at the bulk crystal structures.

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