

MINIMAL SURFACE DESCRIPTION OF CRYSTAL STRUCTURES

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Since the birth of crystallography, solid state crystalline forms have been analysed in terms of aggregates of plane-faced Euclidean polyhedra. Crystals have been viewed as translationally symmetric collections of "unit cells" - the basic building block of a crystal - with atoms located in special positions within the polyhedral array which describes the crystal. This approach has been vindicated largely empirically, with surprisingly recent attempts to place it on firm theoretical ground [1].

Thus, the symmetry of the macroscopic crystal reflects the symmetry of the unit cell, giving rise to the characteristic prismatic morphologies of crystal faces. The archetypal "classical" solid-state crystal is completely specified by its unit cell, with translation periodicity and symmetry dictated by the unit cell geometry. In the jargon of a crystallographer, the classical crystal has complete "long-range order".

In contrast, another atomic arrangement exists in the solid state. This is conventionally described as a random network, with short-range order with respect to each skeletal atom (eg. silicon in silicate glasses) but lacking long-range order [2]. These short-range ordered structures have been described as random packings of various polyhedra [3].