**Poster Presentation**

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## *Development of teaching materials to learn crystallographic symmetry*

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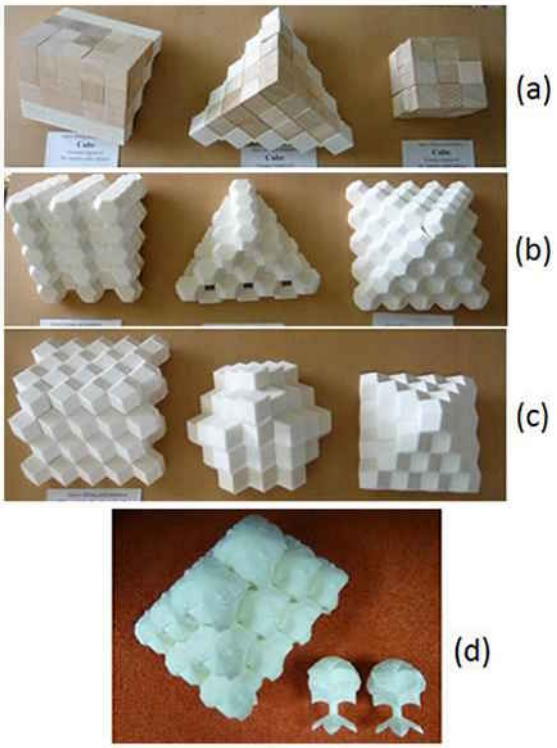
Authors have developed proper polyhedron models to enable people to learn the concept of three-dimensional symmetry. Touching and operating the symmetry elements of the proper polyhedron enables people to understand symmetry. In this study, authors made three-dimensional tessellation models. Certain polyhedra can be stacked in a regular periodic pattern to fill three-dimensional space completely. Figures show our models. The cube (Fig. (a)) is the only regular polyhedron to fill three-dimensional space completely. The cube is a Voronoi region of the simple cubic lattice (sc). The truncated octahedron (Fig. (b)) is the only Archimedean solid to fill three-dimensional space completely. The truncated octahedron is a Voronoi region of the body-centered cubic lattice (bcc). The rhombic dodecahedron (Fig. (c)) is the only Catalan solid (or Archimedean dual) to fill three-dimensional space completely. The rhombic dodecahedron is a Voronoi region of the face-centered cubic lattice (fcc). Figs. (a), (b), and (c) show three kinds of their aggregate respectively. In each of left-hand aggregate, there is a two-fold rotational axis along a vertical direction. In each of central aggregate, there is a three-fold rotational axis along a vertical direction. In each of right-hand aggregate, there is a four-fold rotational axis along a vertical direction. Fig. (d) is a nontrivial polyhedron to fill three-dimensional space completely. The external shape of the polyhedron was designed as a tree shape. We call such a model three-dimensional Escher shape (3DES) [1]. This can be stacked in a regular periodic pattern too.

***[1]*** *Watanabe, Y., Ikegami, Y. Murakami, Y., et al., Acta Cryst. (2008). A64, C634-635 (IUCr congress 2008 in Osaka)*




**Keywords:** teaching materials for crystallographic symmetry, three-dimensional tessellation models, layered manufacturing