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INEXPENSIVE CRYSTAL STRUCTURE MODELS OF FRAMEWORK TETRAHEDRA.

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INTRODUCTION

Tetrahedral framework models are particularly useful in the study, description, and visualization of the crystal structures of framework minerals such as tectosilicates. Techniques for building such models have been described by a number of authors, among them Tilton (1957), Meier (1960), Smith (1960), and Fieser (1963). V. Schomaker, cited by Breck (1964), developed a method for making models built of welded stainless steel tetrahedra joined by plastic sleeves. Here, we describe a method for producing large numbers of wire tetrahedra without expensive apparatus or materials.

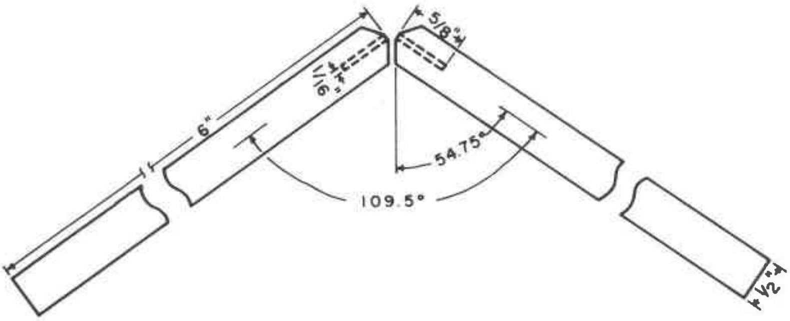


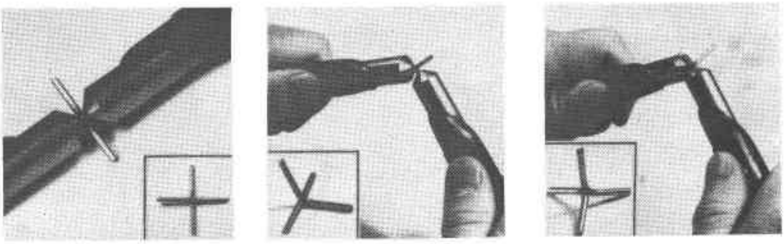
FIG. 1. Benders. Plastic grips may be added to prevent slipping.

MATERIALS AND TOOLS

1. Welded, galvanized fence wire, 16 gauge (.0625"), 1"×1" mesh (current price for 3" fencing from Montgomery Ward, 26¢ per foot or $23.50 per hundred feet). One running foot yields 420 tetrahedra at a cost of about 6¢ per hundred.
2. Polyvinylchloride (PVC) tubing, size 16 (.053" i.d.), clear or colored (current price for 100′ rolls, $1.83). One hundred feet yields enough tubing to join about 1200 tetrahedra, at a cost of about 15¢ per hundred.
3. Lineman's pliers (e.g. Crescent 50-7), chosen to give 1/2" cut. Other pliers that are slightly too large can be easily modified to give the proper depth of cut by grinding down the face opposite the cutters.
4. Benders-two steel rods with axial holes 5/8" deep and 1/16" in diameter, beveled to 55° at the drilled end (Fig. 1). They could have flat faces instead of conical ends.

PROCEDURE

The technique for producing tetrahedra is simple and rapid. A hundred tetrahedra can be produced in an hour without prior experience. The first step is to reduce a length of fencing to one-inch crosses with the cutters. Figure 2a shows such a cross in the inset, and above it the cross inserted in the benders. Figures 2b and 2c show the final two steps.



(a) (b) (c)

FIG. 2a. Wire cross positioned in benders. Inset: cross.
FIG. 2b. First bend. Inset: result at this stage.
FIG. 2c. Second bend. Inset: completed tetrahedron.

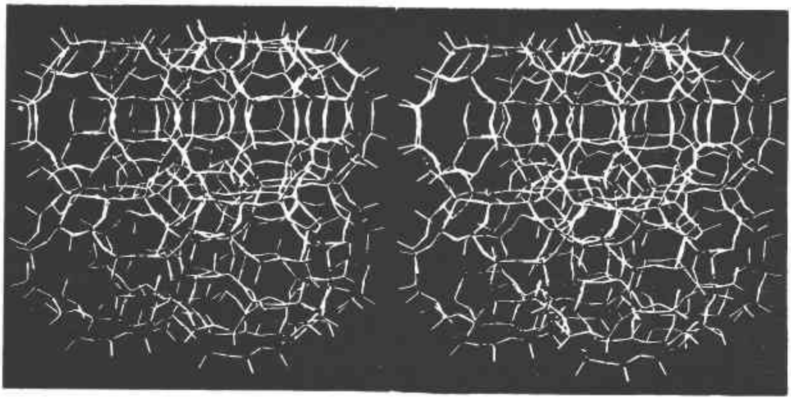


FIG. 3. Stereopair of Linde zeolite type A model.

In producing a model, the tetrahedra are joined by 1/2-inch sleeves of plastic tubing. A simple way to cut uniform lengths of tubing is to mark off 1/2 inch on a board and cut successive lengths with a single-edge razor blade, feeding the tubing with one hand and cutting with the other. The joint itself is best made by initially overlapping the ends of the tetrahedra a little bit inside the sleeve and then pulling them back slightly to make a smooth junction.

The stereopair in Figure 3 shows an eight-unit framework model of Linde zeolite type A constructed by this method. The total cost of materials in this model is 55¢.

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INFRARED SPECTRA OF PHOSPHATE MINERALS: SPLITTING AND FREQUENCY SHIFTS ASSOCIATED WITH SUBSTITUTION OF PO_4^{3-} FOR AsO_4^{3-} In MIMETITE ($Pb_5(AsO_4)_3Cl$)

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An earlier paper (Adler, 1964) presented infrared absorption data on the ν_3 and ν_1 vibrational modes of apatite, pyromorphite, mimetite,