Frits are materials prepared by the ceramic industry for a wide range of products that employ a clay, glass, or glaze base. They can be used as an additive to clay bodies to strengthen them, improve the glaze fit, limit problems of glaze defects, lower the vitrification point, and even render toxic materials inert. Their main use is in glazes, where carefully compounded frits can simplify the glaze preparation. They also promote quicker melting than would occur with the raw materials in the glaze batch.

**Frittine Materials for Ceramic Use**

Fritting materials for ceramic use is done for to eliminate solubility and toxicity of certain materials. For example, fluxes such as soda ash or boric acid readily dissolve in water and leave the rest of the materials on the surface of the pot as they travel with the water into the porous bisque, or to the surface as water evaporates. If they are fused together, the resulting glassy composition eliminates most of the problem aspects of these raw materials.

Frits are made in a simple five-step process. The materials for the frit batch are selected from borax, silica, soda ash, feldspar, boron, and so on down a long list of raw materials, according to the desired formula. This mixture is then thoroughly blended and heated to a temperature in the range of 2192°F (1200°C), at which point the glass composition becomes molten. The molten glass is then made to flow continuously into water, or through water-cooled rollers, to cool it quickly. Thermal shock shatters the glass; when shattered in water, the frit may resemble coarse salt. When quenched through rollers it looks like small flakes of a broken sheet of very thin glass. The resulting material is then finely ground.

The compositions, or formulas, can vary to an almost limitless degree. The chemicals and minerals selected, the quantities of each, the blending, the smelting rate, and the smelting atmosphere all contribute to the final properties of the frit. But despite the nearly infinite variety of available frits, for ease of reference they are categorized as either lead frits or leadless frits. Other than for very specific colors, lead frits are being phased out.

It becomes obvious, when you know how frits are compounded and the stringency of the quality controls observed during manufacture, that frits can be a real boon to the ceramist who wishes to be...
sure of his or her glaze results. They are particularly useful for the person who wishes to work in the lower temperature ranges where few materials melt readily, and those that do, such as borax and boron, have various properties that cause them to be difficult to use.

**FRITS IN BODIES AND GLAZES**

Frits may be used in both bodies and glazes. Commonly used frits for bodies are Ferro 3110 or Pemco P1505, although many other frits can be used. In earthenware glazes, frits can be used as the primary material where only the addition of a small amount of clay is needed to bond the raw glaze to the body. They can also be thought of as one material that can be used in the group of materials that cause fluxing action in the formation of glaze at any temperature. They can be used, at low temperatures, in much the same way as feldspar materials are used at high temperatures, or they can be used in combination with one another for specific effect. Thus the potential employment of frits as a glaze material is very wide, and in fact has seen less application than would be expected of such useful materials.

Because of the variety of frit formulations and the variety of materials they contain, it becomes quite difficult to make choices. However, if you think of them as single materials and test them in the same way as any other single materials already mentioned, their potential use will soon become evident. The only difficulty in this approach occurs when you create a glaze containing frits only to discover later that certain needed colors are inhibited by materials in the frit. On the other hand, some colors are very much enhanced by the right selection of fritted material.

I’ve included a list of common frits. Many companies produce similar frits, and each company has its own numbering system. Ferro Frit 3110 is generally referred to as a body frit, although it may well be used for glazes. Many frits that are usually used for glazes may likewise be used as body frits. Test frits for use in glazes using calculation methods or by the “try it and see” process. This will quickly give observable reactions and results. ■

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**RECIPEs**

**Cracked Clear**

*Cone 06*

- Ferro Frit 3134 . . . . . . . . . . . . . . . . . 89 %
- Calcined Kaolin . . . . . . . . . . . . . . . . . 11 %
- **100 %**
- Add: Bentonite 2 %

**Light Opaque**

*Cone 06*

- Ferro Frit 3134 . . . . . . . . . . . . . . . . . 63 %
- Calcined Kaolin . . . . . . . . . . . . . . . . . 37 %
- **100 %**
- Add: Bentonite 2 %

**Clear**

*Cone 4*

- Ferro Frit 3134 . . . . . . . . . . . . . . . . . 74 %
- Calcined Kaolin . . . . . . . . . . . . . . . . . 26 %
- **100 %**
- Add: Bentonite 2 %

**Opaque**

*Cone 4*

- Ferro Frit 3134 . . . . . . . . . . . . . . . . . 52 %
- Calcined Kaolin . . . . . . . . . . . . . . . . . 48 %
- **100 %**
- Add: Bentonite 2 %

**High Fire Clear**

*Cone 9*

- Ferro Frit 3134 . . . . . . . . . . . . . . . . . 64 %
- Calcined Kaolin . . . . . . . . . . . . . . . . . 36 %
- **100 %**
- Add: Bentonite 2 %

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Excerpted from Robin Hopper’s The Ceramic Spectrum with recipes from Richard Behrens.