Heat Insulation

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While engaged in developing a method for extracting the chemical values of pottery clays, attention was called to the necessity of providing some economic outlet or outlets for the ever present silica component derived from the clays.

The silica is in the form of nearly pure colloidal silicic acid. As produced by our method in the routine break-down of the clays it emerges as a material of extreme granular fineness. By actual measurement its particles have been found to be less than one-twenty-five thousandth of an inch in diameter. Several valuable outlets have been developed which depend for their effectiveness upon the fineness and chemical stability of the silica under the assumed operative conditions.

The particular value here emphasized is its adaptability to heat insulation. Early it was recognized that our silica physically is related closely to "silica gel" which may be obtained on the open market. However, it differs from this material in the fineness of its particles. On the other hand we have noted certain similarities to diatomaceous earth. We will give our method of preparation of this form of silica which we have named "Presil".

In the above mentioned process for the economic break-down of pottery clays to the end that metallurgical alumina and silica, each of the highest purity, be obtained, the latter material emerges as precipitated silicic acid, and separates as a soft wet pulp. This is dried, pulverized, and furnaced to low redness. The resulting powdery product is what we have named "Presil" (prepared silica). The apparent specific gravity of Presil powder is approximately 0.200. When moistened the particles adhere only when wet, but upon re-drying they fall apart readily from one another, and the same light powder results.

In order that this Presil be molded into brick or tile, or be used as a plaster, it must be made plastic. This may be brought about by adding some other material to the Presil, such as caustic or lime. Or, it may be possible to bring about a slight alteration of the particles themselves so that they will adhere to one another with reasonable tenacity after the moistened mixture shall have dried. We tried various expedients and finally devised the slight alteration of the particles themselves to such an extent that they hold to one another with marked tenacity after drying. The altered Presil we have named Plastosil (plastic silica).

When Plastosil is mixed thoroughly with water of the proper amount it takes on the general physical characteristics of glazer's putty. The plasticized batch may be molded, extruded, or otherwise shaped. It air-dries easily. The dried form does not warp, buckle, spall, or shrink markedly when furnaced to 1800° F. Its tensile strength is about 130 lbs. per sq. in. It does not have notable crushing strength. The apparent specific gravity of the dried product is 0.550. Microscopic inspection of the broken faces indicates the body to be shot through and through with air cells. Furthermore when those air cells are examined under the microscope they are seen to be smooth-lined, as though they are plastered by a fine textured cement. The walls of the cells appear as though the separate particles of Plastosil have been compacted densely each with its neighbor. The true density of this material, referring to tridymite, may be assumed quite reasonably to approximate 2.200. Thus we have a body, aid-dried, consisting of twenty per cent hard tridymite silica and eighty per cent air. The air-dried body takes up water to a large degree before showing signs of wetness and much more before it shows signs of softening. The furnaced body takes up water and air-dries readily but does not soften with excess of water. Its physical strength, however, is not as great as that of the air-dried body. The atmospheric hygroscopicity of the air-dried Plastosil is almost nil and that of the furnaced Plastosil is not detectable. The heat insulation value of a material depends directly upon the mass and stability of dissociated "dead air" pockets per unit area per unit thickness and also upon the heat conductivity of the material substance itself, which encloses those dead air pockets. The completeness of isolation of the dead air pockets from outside currents of air adds great technical value to the insulation material. The material should be non-combustible and antagonistic to a tolerance of vermin. It should remain rigid. It should be light. Last of all it should be inexpensive in itself and be applied inexpensively.

The coefficient heat transmissivity of air-dried Plastosil is about the same as that of prime cork. Subjected to atmospheric pressure on one side and vacuum on the other, Plastosil and prime cork are in a class by themselves with respect to transfer of air through the substance body. No other insulator approaches them in this excellent quality.

On account of the inexhaustible supply of silica from which Plastosil may be prepared, the inexpensiveness of the product, and its excellence and adaptability to so many and varied calls for an insulating material of its properties, we look for its wide use in house and building construction.