On Solutions of Silicic Acid in Acetone

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Abstract

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In the literature there are only isolated indications of the possibility of extracting silicic acid with polar organic compounds ([1], [2]). This process is based on the formation of complexes of silicic acid with organic compounds of a certain type. Data on the possibility of extracting silicic acid from aqueous solutions with acetone are absent from the literature.

In connection with the technical problem of finding a method for obtaining sufficiently stable and concentrated solutions of silicic acid that could serve as a binder for the preparation of refractory coatings used in investment casting production, the possibility of obtaining solutions of silicic acid in acetone and the properties of these solutions were studied. Acetone was chosen as the most readily available organic solvent possessing sufficiently high volatility.

To obtain an acetone solution of silicic acid, liquid glass served as the starting material. After its neutralization with sulfuric acid, carried out with such calculation that the acidity corresponded to 0.1–0.2 N, and the temperature did not exceed 18°, the solution was mixed with an equal volume of acetone and salting-out with sodium chloride was performed. After stratification, the acetone layer could easily be separated from the aqueous layer.

The acetone solution obtained in this way contained 11–12 wt.% SiO_2. The content of silicic acid in the acetone solution depended mainly on the volume of acetone taken for extraction. By decreasing the volume, the content of silicic acid in the acetone solution can be increased to 18–19% SiO_2. The stability of the acetone solutions obtained decreases with increasing concentration of silicic acid; as the solutions stood, a gelation process was observed. Solutions with a content of up to 12% could be preserved for several months without visible changes, whereas in solutions containing 18–19% SiO_2, a gel appeared after only 2 weeks. The density of the acetone solutions increased with increasing concentration of silicic acid, and for 18–19% solutions it exceeded 1.0; however, no direct proportionality between the density of the solution and its content of silicic acid was observed.

Acetone extracts silicic acid that is polymerized to varying degrees. Polymerization of silicic acid continues in the acetone solution itself. It was natural to suppose that the less polymerized the silicic acid in the aqueous solution before extraction, the more stable the acetone solution should be. Experiment fully

confirms this proposition. The rate of polymerization of silicic acid in aqueous solutions is lowest at pH 1–2; this circumstance also determined the choice of the acidity of the neutralized solution.

Experiment showed that, for obtaining a stable acetone solution of silicic acid, the duration of contact has substantial importance.

contact of an aqueous solution of silicic acid with acetone; to obtain stable solutions, 3-5 minutes of mechanical mixing of the aqueous solution with acetone is necessary. A further increase in the duration of extraction leads only to a slight increase in the concentration of silicic acid and, at the same time, to a decrease in the stability of the solution. Acetone solutions of silicic acid are of considerable practical importance. The nature of these solutions has not yet been sufficiently clarified and deserves more detailed study.

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CITED LITERATURE

[1] R. Iler, P. Pinkey, Ind. and Eng. Chem., **11**, 1379 (1947).
[2] R. Iler, J. Phys. Chem., **56**, 6, 673 (1952).

Note: Figure translations are in progress. See original paper for figures.