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STUDIES ON MYSORE VERMICULITE

VERMICULITE (A COMPLEX HYDRATED ALUminium, iron, magnesium silicate) in its exfoliated form has been used as a building and an insulating material in other countries for the past quarter of a century. The occurrence of vermiculite was first reported from Mysore in the year 1948 and subsequently some more deposits were discovered in other States, e.g. Ajmer-Marwar, Bihar, Bengal and Madras. In order to find out if Indian vermiculites can be utilized as a building and insulating material, the quality and characteristics of the Indian varieties have been compared with those used elsewhere.

Exfoliation studies reported in this note were carried out with Mysore vermiculite. A cleaned sample of vermiculite from South Africa which was considered to be of good quality was used as control.

Raw vermiculite consisting of flakes and powdery material was cleaned and sieved through sieves of different sizes before exfoliation. The fraction passing through $\frac{3}{16}$ in. mesh and retained on 100 mesh amounted to 75%. About 8% was lost during the initial cleaning operation.

Exfoliation was carried out in an electrically heated muffle furnace.

Effect of temperature — Exfoliation was carried out by heating the mineral at temperatures between 300° and 1,000°C. The ratio of densities before and after exfoliation (exfoliation ratio) at each temperature is recorded in Fig. 1. Although the maximum exfoliation was attained at 1,000°C., 900°C. may be taken as the optimum temperature for exfoliating Mysore vermiculite; at higher temperature the product

TABLE 1 — DRY DENSITY AND COMPRESSIVE STRENGTH OF VERMICULITE CONCRETES

(Vermiculite passing through 3/8 in. sieve and retained on 25 mesh was used)

Properties	Cement : vermiculite					
	1 : 2	1 : 3	1 : 4	1 : 6	1 : 8	1 : 12
Density (oven dry), lb./cu. ft.	67·6	56·3	43·8	35·6	31·8	28·5
Compressive strength (7 days), lb./sq. in.	353·0	270·0	184·0	76·0	56·0	39·2

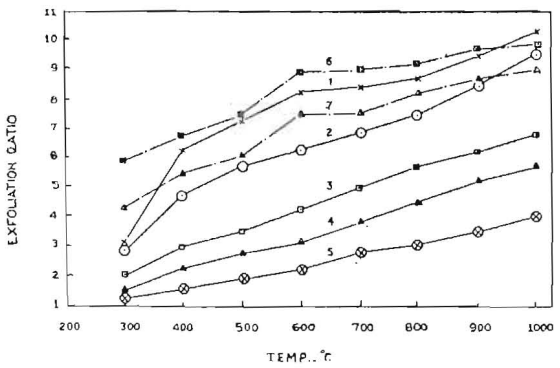

FIG. 1 — EFFECT OF TEMPERATURE ON EXFOLIATION OF VERMICULITE [Mesh sizes — *Mysore vermiculite*: (1) $-\frac{3}{8}+\frac{3}{16}$ in.; (2) −36 + 7 in.; (3) −7+ 14 in.; (4) −14+25 in.; (5) −25 in.; *S. African vermiculite*: (6) $\frac{3}{8}+\frac{3}{16}$ in.; and (7) $-\frac{3}{16}+7$ in.]

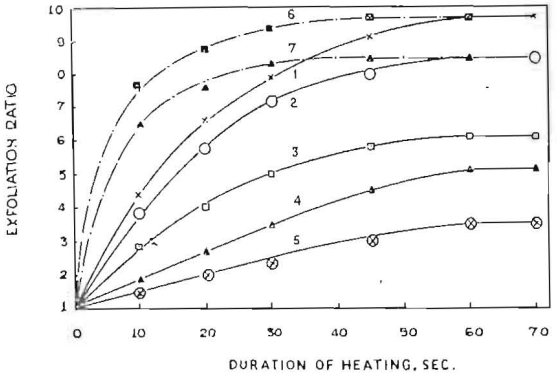

FIG. 2 — EFFECT OF VARYING THE DURATION OF HEATING AT 900°C. ON THE EXFOLIATION OF VERMICULITE [Mesh sizes — *Mysore vermiculite*: (1) $-\frac{3}{8}+\frac{3}{16}$ in.; (2) −36+7 in.; (3) −7+14 in.; (4) −14+25 in.; (5) −25 in.; *S. African vermiculite*: (6) $\frac{3}{8}+\frac{3}{16}$ in.; and (7) $-\frac{3}{16}+7$ in.]

tends to become brittle and breaks into smaller sizes on the application of slight pressure.

Duration of heating — The mineral was exfoliated by heating it at 900°C. for different intervals. The results are recorded in Fig. 2. It was found that there is no advantage in heating material for more than 60 sec.; heating for 45 sec. gave results approximating to that of the optimum.

Exfoliation of Mysore vermiculite is best carried out by heating the mineral at 900°C. for 45 sec.

The percentage water absorption (by weight) of different particle sizes after exfoliation was determined as this information is useful in determining water-cement ratio while making vermiculite concrete. Vermiculite absorbs about two times its own weight of water within 5 min. of immersion. With lower-size fractions, there is not much difference in the values, when they are immersed in water for 5 min. or 24 hr.; with higher-size fractions considerable variation is observed.

Cold exfoliation — Certain vermiculites can be exfoliated by treatment with oxidizing agents such as hydrogen peroxide. Mysore vermiculite exfoliates in the cold when treated with hydrogen peroxide. In the case of cold exfoliation much lower densities (4·36 lb./cu. ft. as against 7·12 lb./cu. ft. by heat treatment under optimum conditions) are attained. However, the cost of this treatment is rather high.

Vermiculite concrete — Test samples of vermiculite concrete were made with different cement-aggregate ratios, and their densities and compressive strengths determined (Table 1).

The fraction passing through $\frac{3}{8}$ in. sieve and retained on 100 mesh represents about 80% of the mineral and has an average exfoliation ratio of 6·3. This fraction is suitable for use as fine aggregates in making concretes and plasters. Further work is in progress.

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