THESIS ON GYPSUM

RESPECTFULLY SUBMITTED

TO

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By

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December 10, 1913.

INTRODUCTION.

Calcium Sulfate is frequently found in nature, accurring in lime stone water or in company with common salt, here it is found in anhydrate form. This has the formulax of $CaSo_4$. It is found in both rhombic and semi-crystaline form. However it is found in the hydrate form known as gypsum, thith with the formulax $CaSo_4 2H_2o$. This corresponds to the composition.

$$CaSo_4 2H_2O = \begin{cases} \text{Lime Sulfate } CaSo_4 \begin{cases} \text{Lime } CaO = 32.6\,\% \\ \text{Sulfurdioxide } SO_3 = 46.5 \end{cases} = 79.1\,\% \\ \text{water} \quad \underline{20.9} \\ \qquad 100\,\% \end{cases}$$

And is usually in a well crystalized form with a hardness of two. Sp. gr. 2.3 it has a silky lusture and iss colorless or a white gray. It has a fracture in three ways.

When it is heated above 120° it looses part of its water, probably having the formulax $CaSo_4 \frac{1}{4} H_2o$ which corresponds to

$$CaSo_4 \tfrac{1}{4} H_2O = \begin{cases} \text{lime Sulfate } CaSo_4 = 96.9 \\ \text{water } H_2O = \underline{3.1} \\ \qquad 100\,\% \end{cases}$$

This can be proven by heating it in a closed tube, water forming on the side of the tube. But most of the chemists claim it has a formular of $CaSo_4 \frac{1}{2} H o$ which would correspond to

$$CaSo_4 \tfrac{1}{2} H_2O = \begin{cases} \text{Lime Sulfate} = 93.8\,\% \\ \text{water } H_2O = \underline{6.2\,\%} \\ \qquad 100\,\% \end{cases}$$

If it is heated to 120° instead of 110° it gives better results although it is generally conceeded that three fourths of the water will go of at 110°. After it has been heated at this temperature it is a soft grayish mass. ~~It~~ form first in the orthrombic system and finally in the monicline system. After it has been heated to this temperature and mixed with water it soon sets to a hard mass. This setting is due to the plaster dissolving little by little in the water in which it is slightly soluable, and then immediatly cystalizing out in a form of minute interlacting crystals or needles which bind the mass together. It seems to have the hardness of about three. It solidfies very quickly under ordinary circumstances with the evolution of heat and expanding in so doing as to fill any mold in which it is a cast. These qualities make it very valuable, and is used very extensively in forming models of artistic figures as well as ornimentations and used in surgery. This is known as plaster paris. The reaction is

$$CaSO_4 2H_2O + heat = CaSO_4 \tfrac{1}{2} H_2O + \tfrac{3}{2} H_2O$$

$$CaSO_4 \tfrac{1}{2} H_2O + \tfrac{3}{2} H_2O = CaSO_4 2H_2O$$

However if it is heated over 200° it looses all of its water as well as its property of harding with the additional water. This is called dead burnt and the loss of this property is generally conceeded to be the lack of nucleui of the more stable form

which has an essential influence on it when present. In this case it lacks the nucleui for the formation of new crystals.

REFERENCES.

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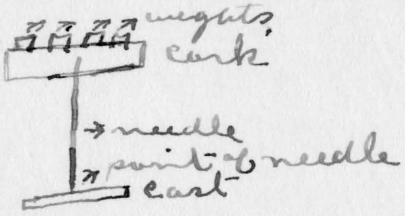
SUBJECT.

The subject of this thesis is to try to prove that dead burnt gypsum will set if it has a nucleui to set around and for this nucleui to be furnished with a given % of either gypsum or plaster of Paris. To confirm the theory that the presence of a nucleui of a stable form has an essential influence and this can be accomplished by adding either dead burnt gypsum or plaster Paris to furnish the nucleui for the formation of new crystals.

PROCESS.

I took a platinum crucible which was about two thirds

full of plaster of paris and heated it before a blow pipe at white heat for about fifteen minutes it probably being 800° to be sure all of the water had been driven off. Small quanities were used that the heat might penetrate the intire mass. This was allowed to cool and then water added . This was put in a cast with three glass sides three forths of an inch wide, two inches long and an inch and a half in heigth, and allowed to dry out. It dried out very slowely and when dried, tested with Vicat needle as to the resisting power



An ordinary darning needle was used with a sharp point and about three inches long. The blunt end was stuck in a cork and the sharp end placed on the mold and weight added to the cork stopper until the darning needle penetrated the cast. Ten grams were added before it broke . This was repeated five or six times in order to prove that it was correct. It was also proven that it was harder just befor intirely dry than when very dry. A cast of it was allowed to dry out and wrapped in a damp rag and allowed to stand over night. It was found harder the next morning than the evening before. When entirely dry it only took five grams to brake it. At high temperature or a very low one it was not as hard as it was at ordinary temperature . It was also proven with all the samples that they

would set quicker and give as good results if heated in a drying closet the temperature between 30° and 40° .

About seven grams of the dead burnt gypsum was used for all the samples in this work and all the casts were practically of the same measurements .

Next I added one per cent of the pure gypsum to the dead burnt . This was put in a mold and allowed to dry. The weights were:

Burnt gypsum 7.0760 grams
7.0760 ÷ 100 = .07760 = 1%

This when dry was tested as to hardness and it took 141 grams to brake it making it 14.1 times as hard as the dead burnt. This was also tested several times in order to prove its corectness. All samples were tested under the same conditions.

I next added 1% of plaster paris to the sample of dead burnt and the weights were as follows:

Dead burnt = 7.542 grams
7.542 ÷ 100 = 07542 = 1%

After this was dry I tested it and found it to be 44.2 times as hard as the dead burnt and little over three times as hard as the sample with 1% of gypsum, And ~~the~~ next I ~~was~~ added 25% of the gypsum to the dead burnt and found it to be 108 times harder than dead burnt.

I added 25% of plaster of paris to a sample of dead burnt and on testing found it to be 145.2 times harder than the dead burnt and just about 1.3 times as hard as 25% of gypsum.

In this way I had a different percent until I got 50% of each, and there could scarcely be any difference told between the 100% of plaster paris and the 50% of plaster paris .

The results of the whole were

1% of gypsum 14 times harder than the dead burnt.

1% of plaster of paris 45 times harder than 1% of gypsum.

25% of gypsum 108 times harder than dead burnt.

25% of plaster of paris , 145 times harder than a dead burnt, and 11/2 times harder than the 25% of gypsum. It was also found that the gypsum took twice as long to set as it did for the plaster of paris.

Owing to the lack of aperatus it was impossible to get the exact resisting power of the cast, but the relation of one to another could be gotten by means of Vicat needle. It was proven that the presence of a nucleui ng of a more stable form did have an essential influence upon the dead burnt gypsum, ~~that~~ to a certain extent the nucluei furnished or rather caused a hardening of a very considerable degree. This is very likely due to the formation of new crystals of the dead burnt furnished by the nucleui of the more stable form.

Respectfully submitted by

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