Relative Abrasiveness of Several Mineral Fillers in Powder Coatings

NYCO's Wollastonite (calcium metasilicate) has been found effective in reducing the gloss of powder coatings without significantly adversely affecting physical properties, smoothness, weatherability or other characteristics.

See Report "NYAD® Wollastonite: Its Effectiveness in Powder Coatings"

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A study was undertaken to directly compare the relative abrasiveness of formulations containing two grades of wollastonite and, as controls, similar powders containing calcium carbonate and barium sulfate. The characteristics of the fillers used in this study are shown in Table 1. Resin chips were prepared in the usual fashion by melt mixing equal weights of resin and filler and compounding on a twin screw extruder. The extrudate was cooled and broken into chips suitable for grinding.

EXPERIMENT

The grinding conditions for this study were set up so the product would be retained in the mill for the maximum time consistent with normal operation of the mill. That is, the conditions were set so maximum abrasion would occur. Parts were weighed before and after the grinding trials and the weight loss due to abrasion determined for each of the four trial mixtures.

The grinding trial was carried out at the Laboratory of Blue Tech. Inc., Hickory, North Carolina using their 10HP Air Purge Classifier Mill (APCM). This type of grinder is widely used in the powder coating industry. Powder chips are introduced into the mill and ground between hammers on a rotor plate and liners. The product is cooled by air circulating through the mill. Before product can escape from the grinding chamber it must pass through an air classifier consisting of rotating blades. If particles are not as fine as desired and are not entrained in the air stream, they are retained in the grinding chamber for further grinding. When they are small enough to be carried through the classifier, they exit the grinding chamber and are collected in a cyclone separator. The degree of fineness can be controlled by changing the speed of the classifier fan. The higher the classifier speed, the more difficult it is for the particles to escape the grinding chamber. That is, the residence time in the grinding chamber is longer.

Most wear would be expected to occur on the hammers and liners but all internal parts were evaluated for weight loss. In the first test, standard steel parts were used. In a second test, abrasion resistant parts (AR) were used. Using a proprietary formula developed by Blue Tech, Inc. the service life of

TABLE 1: CHARACTERISTICS OF FILLERS

COMMON NAME	CALCIUM CARBONATE	BARIUM SULFATE	NYAD® 400	NYAD® 1250
Type	Calcite	Barite	Wollastonite	Wollastonite
Average Particle Size (µm)	11	3	6.9	2.9
Hegman Grind	3	6	4	6
Oil Absorption	18	13	22	32
Specific Gravity	2.7	4.4	2.9	2.9
Mohs Hardness	3	2.5 - 3.5	4.5 - 5.0	4.5 - 5.0

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TABLE 2: ESTIMATED SERVICE LIFE OF GRINDER (APPROXIMATE SERVICE LIFE (DAYS)

	STANDARD COMPONENTS		ABRASION RESISTANT COMPONENTS	
Filler	**Hammers**	**Liners**	**Hammers**	**Liners**
Calcium Carbonate	**90**	**110**	**360**	**435**
Barytes	**87**	**108**	**357**	**433**
NYAD® 400	**86**	**108**	**356**	**434**
NYAD® 1250	**84**	**106**	**355**	**431**

hammers and liners was calculated based on the loss due to abrasion and normal throughput rates for grinding. These results are given in Table 2.

CONCLUSION

There is only a slight difference in the abrasiveness of the four different compounds. It is possible that the wollastonite may have been more highly abrasive at some time in the past. However, improved separation procedures instituted in the early 1990's effectively reduced the presence of garnet, a highly abrasive component.

Considering the abrasion resistant parts last approximately four times as long and cost only about 20% more than standard parts, their advantage is obvious.

Further, with abrasion resistant parts there is practically no difference in service life regardless of the type of filler used. Therefore, wollastonite can be used with confidence in formulating coating powders without fear of excessive abrasion on processing equipment.

TYPICAL PROPERTIES OF NYAD WOLLASTONITE

Appearance	WHITE
Morphology	ACICULAR
Molecular Weight	116
Specific Gravity	2.9
Refractive Index	1.63
pH (10% slurry)	9.9
Water Solubility (g/100cc)	0.0095
Density (lbs./cu.ft.)	181
Bulking Value (gal./lbs.)	0.0413
Mohs Hardness	4.5
Coefficient of Expansion (mm/mm/˚C)	6.5×10^{-6}
Melting Point (˚C) - theoretical **Melting Point (˚C) - by ASTM D1857**	1540 1410