Gilsonite

Physical & Chemical

Physical Properties of Gilsonite

Color in Mass	Black
Color in Streak or Powder	Brown - Dark Brown
Softening Point	265-600 °F
Moisture Content	0.5 - 3.5% %
Ash Content	0.5 % - 12%
Specific Gravity @ 77°F	1.04-1.06
Hardness (Moh's Scale)	2
Penetration	0 - 2
Volatility, Weight %,	
5 Hours @ 325°F	< 2%
5 Hours @ 400°F	< 4%
5 Hours @ 500°F	< 5%
Flash Point, C.O.C.	450-600 °F
Acid Value	2.3
Saponification Value	5.6
Iodine Number	0
Heat of Combustion	17,900 Btu / lb.
Heat of Fusion	9990 Btu / lb.
Specific Heat of Solid Phase	0.52 Btu / lb. / °F
Specific Heat of Liquid Phase	0.61 Btu / lb. / °F
Glass Transition Temperature, T_g	185-250 °F
Bulk Density, Lump	40 lbs. / ft^3
Electrical Resistivity	4.0 x 10^{12} ohm-cm
Viscosity, Brookfield	
@ 375°F	
@ 400°F	55,000 cps
@ 425°F	22,800 cps
@ 450°F	6,600 cps
	2,800 cps

Proximate Analysis:	Weight %
Carbon	70-80
Hydrogen	20-25
Nitrogen	3.3
Sulfur	3
Oxygen	1.4
Trace elements	0.1
	100.0
Aliphatic carbon	68.3
Aromatic carbon	31.7
H/C atomic ratio	1.42

	Weight %
Volatile matter	75-78%
Fixed carbon	20%
Ash	2%
	100.0

Molecular Structure:
A variety of sophisticated analytical tests have been run on Gilsonite from the Uintah Basin to characterize its unique properties. For reference, the test methods include vacuum thermal gravimetric analysis (TGA), nuclear magnetic resonance (NMR), Fourier transform infrared spectrometry (FTIR), vapor pressure osometry (VPO), high performance liquid chromatography (HPLC), rapid capillary gas chromatography (RCAP), and several fractionation techniques. H/C ratios and NMR analysis indicate the presence of a significant aromatic fraction. Most of the aromatics exist in stable, conjugated systems, probably porphyrin-like structures that relate to the geologic source of the product. The remainder of the product consists of long, paraffinic chains.

A very unique feature of Gilsonite is its high nitrogen content, which is present mainly as pyrrole, pyridine, and amide functional groups. Phenolic and carbonyl groups are also present. The low oxygen content relative to nitrogen suggests that much of the nitrogen has basic functionality. This probably accounts for Gilsonite's special surface wetting properties and resistance to free radical oxidation. The average molecular weight of Gilsonite is about 3000. This is very high relative to other asphalt products and to most synthetic resins. This may relate to Gilsonite's "semi-polymeric" behavior when used as a modifying resin in polymeric and elastomeric systems. There is some reactive potential in Gilsonite. Crosslinking and addition type reactions have been observed. Gilsonite is known to react with formaldehyde compounds under certain conditions.

	Softening Point, °F			
Typical Component Analysis	290	320	350	375
Asphaltenes	57	66	71	76
Resins (Maltenes)	37	30	27	21
Oils	6	4	2	3
	100	100	100	100