GILSONITE SELECTS

CHEMICAL PROPERTIES OF GILSONITE

Gilsonite is included in a class of solid bitumens known as asphaltites. Gilsonite deposits are located in eastern Utah in the United States. They are different from other asphaltites because of their:

- high asphaltene content
- high solubility in organic solvents
- high purity and consistent properties
- high molecular weight
- high nitrogen content

Gilsonite is available in different grades categorized by softening point. Softening point is used as an approximate guide to melt viscosity and behavior in solution. The chemical differences are small between Gilsonite grades, with only subtle variations in average molecular weight and asphaltene/resin-oil ratios.

The precursor of Gilsonite is believed to be kerogen from the Green River formation deep below the Uintah Basin in eastern Utah. Mild thermal reductive degradation of this kerogen and subsequent fractionation as it was geologically squeezed to the surface are believed to be responsible for the formation of the unique deposits we mine today.

Elemental Analysis

	Weight %
Carbon	84.9
Hydrogen	10.0
Nitrogen	3.3
Sulfur	0.3
Oxygen	1.4
Trace elements	0.1
	100.0
Aliphatic carbon	68.3
Aromatic carbon	31.7
H/C atomic ratio	1.42

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CHEMICAL PROPERTIES OF GILSONITE, Continued

Proximate Analysis

	Weight %
Volatile matter	84.5
Fixed carbon	15.0
Ash	0.5
	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.

Typical	Softening Point, °F			
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

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.