

MSE-402

TYPE, RANK, CLASS AND GRADE OF COAL

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Type, rank, class and grade of coal are commonly used to differentiate its nature which has specific meaning.

Type of coal:

The word type of coal indicates whether it is anthracite, bituminous or lignite coal.

All these three types of coal have distinct properties:

(i) Lignite:

It is brown/black in colour with considerable amount of moisture to soil the hand. It is fibrous in nature and crumbles easily on pressing. It has high porosity. It contains high volatile constituents with low fixed carbon.

(ii) Bituminous coal:

It has characteristic layers of bright and dull banded matter. It has typical cubic fracture. It is relatively hard (3–4 Mohs scale) in nature. It burns easily with smoky yellow flame. It has many commercial applications. The

coking coals falling under this type are used for coke making.

(iii) Anthracite:

It is a hard and compact variety of coal with pitch like appearance. It breaks with irregular fracture and does not soil the finger on rubbing. Anthracite ignites with difficulty, but once ignited, it burns and gives intense local heat with very short and non-luminous flames. Anthracite does not have caking property and is unsuitable for coke making. It has limited industrial use as fuel, but often used to make artifacts.

Rank of coal:

The word rank denotes the degree of coalification the peat has undergone to yield coal. The carbon content and calorific value of coal increase with rank, while the volatile matter is found to decrease. The different coals with increasing rank can be shown as:

Lignite → Bituminous → Anthracite.

Class of coal:




The term class is retained for its actual use such as coking coal, steam raising coal, gas making coal, etc.

Grade of coal:

The grade refers to the degree of purity of the coal. The coals with higher ash and moisture content are referred as lower grade coals, while high grade coal, means coal with low ash and moisture content.

Coal Constituents:

The coal contains various constituents to render specific properties which cause its selection for various applications. These constituents could be grouped in three categories viz.

-  Petrological constituents,
-  Elemental constituents and
-  Constituents important for its use.

Petrological Constituents in Coal:

The coal contains various constituents which can be identified under geological microscope. These Petrological constituents are known as macerals. These macerals differ

significantly in their properties present in various coals. These macerals are grouped as vitrinite, exinite and inertinite.

Vitrinite:

It is a primary constituent of coal. It usually occurs in bands. It is bright, black and brittle having conchoidal fracture. It is derived from woody tissues of the plant from which it was formed. Chemically, it is rich in polymers, cellulose $(C_6H_{10}O_5)_n$ and lignin $(C_{30}H_{33}O_{11})$. It burns easily during combustion.

Exinite:

This group of macerals is minor component of coal. These are rich in volatiles and hydrogen content that render it most reactive.

Inertinite:

It is oxidized organic material or fossilized charcoal. It is found as tiny flakes, generally forming 1–3 per cent in coal seam. It is least reactive group of macerals. The most common inertinite maceral is fusinite.

The natural minerals of different types are also found to be present in coal. These minerals get incorporated in early stage of peat formation. The intrinsic mineral matter originates from minerals present in the wood, since trees need various minerals as nutrient. These mineral constituents are finely sized and remain distributed in the whole coal body as fine particles. Such fine size mineral matter cannot be separated from coal by washing methods. The extrinsic mineral matters are those which get incorporated with peat during its formation and collection process. The extrinsic mineral matters are present in bulk and could be separated by coal cleaning methods. These mineral matters are uncombustible constituents and remain as ash after coal combustion. These mineral matters are not desired in coal.

Elemental Constituents in Coal:

The major elements present in coal are **carbon, hydrogen and oxygen.** The minor elements include nitrogen, sulphur and phosphorus. In addition, any known element could be present in trace quantity. The results of the analysis is reported as weight per cent of each element present in coal including major (in bulk percent), minor (in per cent) and trace constituents (in ppm, i.e., parts per

million and ppb i.e. parts per billion) depending upon its need. Such elemental analysis of coal is reported as ultimate analysis.

Ultimate Analysis:

The ultimate analysis of coal is beneficial in estimating air requirements for its combustion and flue or exit gas analysis along with estimation of its calorific value. The occurrence of minor constituent like Sulphur (wt.%) helps in deciding pollution abatement methods caused by its emission. The trace elements in coal would be discharged along with ash and flue gases. The presence and quantity of trace elements in coal help in providing satisfactory management systems to avoid hazards instigated by toxic elements such as As, Hg, Cr, Cd, Pb, and other radioactive elements.