

FINAL REPORT

Outbursting Scoping Study

**C4034
March 1996**

9.2.3 Polish Desorbometer

Polish desorbometer measures the ΔP value in terms of water gauge using a 3 g sample of size fractions +0.5 to -1.0 mm. Samples are taken from a 42 mm diameter hole drilled to a depth of 3 m and cuttings are collected from the last 10 cm of drill hole. Fractions are sealed and test started within 35 s and observations are made over the next 120 s. ΔP values (H_2O gauge) are reported as $\Delta P_{0.5}$, ΔP_1 and ΔP_2 which refer to water gauge reading at elapsed times of 0.5 min, 1 min and 2 minutes after sealing the sample (Tarnowski, 1966, 1968). The ΔP equal to 120 mm of H_2O over 2 minute period has been found to be the limiting value for defining conditions of an imminent outburst in anthracite mines with CO_2 in Lower Silesian coal field (basin), Poland (Kozłowski and Polak, 1978 a, b).

Some of the ΔP indices used in various countries are given in Table 9.2.

9.2.4 K_T Index

This index is a measure of the change in desorption rate of a coal sample. The emission of gas from a coal sample can be related to a power function of the type

$$\frac{\dot{V}_2}{\dot{V}_1} = \left(\frac{T_2}{T_1} \right)^{K_t} \quad (9.3)$$

Taking the logs from both sides

$$K_t = \left(\frac{\ln \dot{V}_1 - \ln \dot{V}_2}{\ln T_2 - \ln T_1} \right) \quad (9.4)$$

where $\dot{V}_{T_1}$ = amount of gas desorbed (cc/g min) at time T_1
 $\dot{V}_{T_2}$ = amount of gas desorbed (cc/g min) at time T_2

Thus if the ratio of gas desorbed is plotted against time on ln-ln scale, the slope of the curve gives the K_T value (Fig. 9.9). Studies conducted have shown that the coefficient K_t is dependent upon a range of parameters. The critical value $K_T < 0.645 \pm 0.035$ is considered normal. For outbursts K_T should be higher or at least 0.75%.

The method of sampling consists of drilling holes and collecting fractions of particles in the range of 0.4 - 0.63 mm. The weight of the sample depends upon the capacity of the equipment. The critical K_t value relates to gas content of $9\text{m}^3/\text{t}$. The slope of the curve (Fig. 9.9) at desorption time of 1 min gives the desorption rate of the sample. This value denoted by $\dot{V}_1$ (at $t = 1$) is related to the K_t value through a relationship

$$\dot{V}_1 = \dot{V}_t t^{K_t} \quad (9.5)$$

This is shown in Fig. 9.10. Thus the amount of gas desorbed over a time a to b can be calculated by integrating and is given by

$$Q_{a-b} = \frac{\dot{V}_1}{(1 - K_t)} (t_b^{1-K_t} - t_a^{1-K_t}) \quad (9.6)$$

The amount of gas desorbed over the time 0 - 1 minute is given by

$$q_{0-1} = \frac{\dot{V}_1}{(1 - K_t)}, \text{ cm}^3/\text{kg} \quad (9.7)$$

The desorbable gas content of coal has been found to be related to $\dot{V}_1$ through a relationship;

$$Q_d = 29.4 \dot{V}_1 - 0.1 \quad (9.8)$$

The above relationship is valid for particle sizes of 0.4 - 0.63 mm. The $\dot{V}_1$ value for $9\text{m}^3/\text{t}$ is $>400 \text{ cm}^3/\text{kg}$.

Fig. 9.11 shows the changes in $\dot{V}_1$ and K_t values while going through an outburst zone in seam #54 in Ibbenbüren Colliery. K_t value variations in Leichhardt Colliery, Gemini seam are given in Fig. 9.12.

Automated equipment has been developed for use underground in mines (Noack, 1995).

Fig. 9.9. Calculation of K_T value

Methandesorptionsstrom in $\text{cm}^3/\text{min kg}$ -
Methane desorption in $\text{cm}^3/\text{min kg}$
Desorptionszeit in min -
Desorption time in minutes

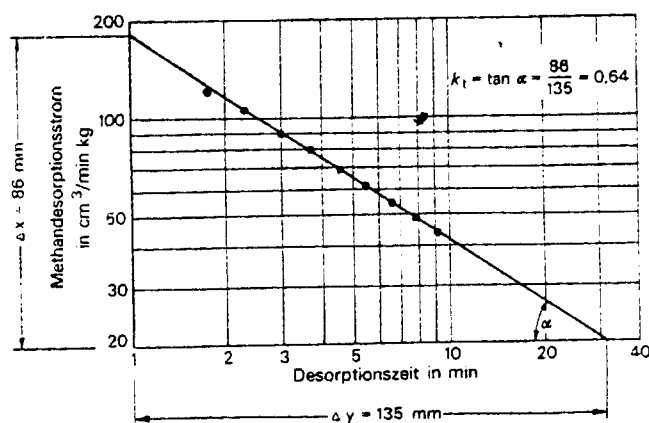
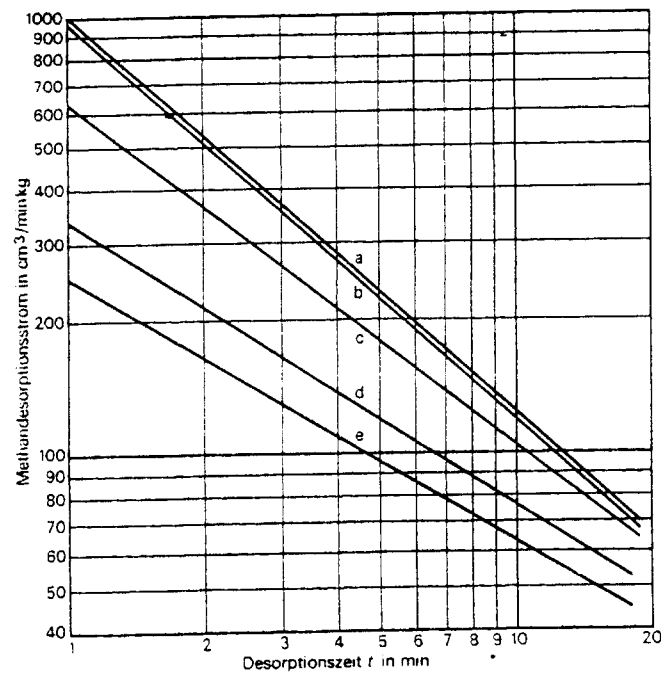


Fig. 9.10. Methane desorption rate for different K_t values (Janas and Winter, 1977).



• $(p-1) = 10$ bar
Particle size $d = 0.2$ to 0.315 mm

Sample	K_t -value	$\dot{V}_1$ value cm³/min.kg
a	0.91	1000
b	0.91	970
c	0.78	630
d	0.65	340
e	0.60	250

Fig. 9.11. K_T and $\dot{V}_1$ values while mining through an outburst zone in #53 seam, Ibbenbüren (Janas and Winter, 1977)

K_t -Wert - K_t -Value

$\dot{V}_1$ -Wert in cm³/min.kg -

$\dot{V}_1$ -value in cm³/min.kg

Streckenlänge in m -

Roadway length, m

Östlicher Stoß - East face

Westlicher Stoß - West face

An beiden Stößen gleich -

Equal value at both the faces

Korngröße $d = 0.2$ bis 0.315 mm -

Particle size between $0.2 - 0.315$ mm

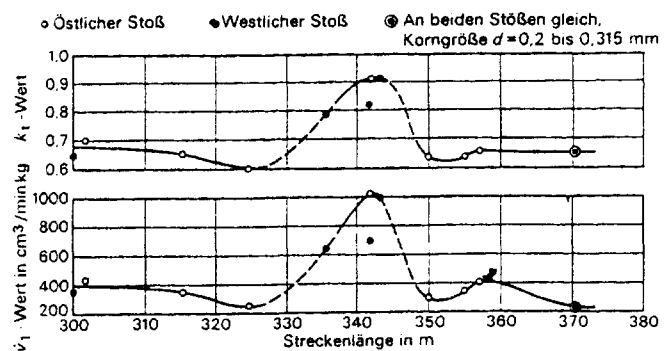


Fig. 9.12. Variations in K_T value in Gemini seam, Leichhardt Colliery (Janas and Winter, 1977).

Glanzkohle - Bright coal
 Mattkohle - Dull coal
 Bergestreifen - Shale band
 Matt-Glanzkohle - Dull-bright coal

