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Surface Areas and Pore Volumes of Coal Macerals

ADSORPTION studies were performed on several sets of coal macerals, which were previously studied by P. H. GIVEN and co-workers[1] as to their chemical properties. *Table 1* presents analyses of the macerals. Studies were made on −200 mesh material.

Table 1. Analysis of macerals used

Sample	Per cent by weight (d.m.m.f.)					Petrographic purity, %	Ash %
	C	H	O	N	S		
V_3 (*vitrinite*)	82·3	5·5	9·3	—	—	98	1·0
E_3 (*exinite*)	82·6	7·4	7·0	—	—	88	0·7
V_5 (*vitrinite*)	86·9	5·4	4·9	—	—	98	0·8
E_5 (*exinite*)	87·2	7·4	3·5	—	—	—	—

Prior to adsorption measurements, samples were degassed at 150°C for at least 4 h, down to a pressure of *ca.* 10^{-6} torr. Adsorption conditions used were: carbon dioxide at 298°K, nitrogen at 77°K, and neopentane at 273°K. Molecular areas taken were 25·3, 16·2, and 62 Å^2, respectively. Equilibration time in all cases was 30 min. Surface areas were calculated using the BET equation. Total open pore volumes accessible to nitrogen and neopentane at a relative pressure close to 1·0 (that is, a pressure of 760 torr for nitrogen and 542 torr for neopentane) were also measured. Liquid densities of nitrogen and neopentane at the temperatures of adsorption were taken as 0·81 and 0·61 g/cm^3, respectively.

Results are presented in *Table 2*. It is clear from the measurable surface areas that at a given carbon content the vitrinites possess a higher microporosity than do the exinites. This is consistent with the findings of C. KRÖGER and co-workers, who report that the heat of wetting of exinites in methanol is lower than that of vitrinites[2].

Table 2. Surface areas and pore volumes of macerals

Sample	Surface area, m^2/g			Open pore volume, $cm^3/g \times 10^3$	
	N_2	Neopentane	CO_2	N_2	Neopentane
V_3	16·2	18·9	272	18·8	19·6
E_3	2·7	<1	106	4·9	7·2
V_5	<1	<1	208	2·2	8·9
E_5	<1	<1	189	2·8	5·7

The higher surface area of the V_3 vitrinite (82·3 per cent carbon) over that of the V_5 vitrinite (86·9 per cent carbon) is consistent with the observed minimum in the accessibility of molecules into the micropores of coal with rank, as shown by previous helium and water density measurements[3–5],

argon diffusion[6], and butane adsorption[7]. Minimum accessibility is found in coals having between 84 to 90 per cent carbon.

The neopentane surface area of vitrinite V_3 is higher than the nitrogen area. Further, the pore volumes accessible to neopentane at a relative pressure of *ca.* 1·0 are greater in every case than those available to nitrogen. By contrast, in the case of anthracites total pore volumes accessible to nitrogen are considerably greater (at least twice) than those accessible to neopentane[8]. These results suggest that imbibition of neopenatne by low rank coals is occurring.

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ABSTRACTS IN FRENCH AND GERMAN

Circumstances outside our control have so delayed preparation of the German abstracts that it has been decided in the interests of punctual publication to hold over for future publication the whole abstract section which would have been included in this issue.