# SORPTION KINETICS OF HEAVY OILS INTO POROUS CARBON MATERIALS BY WICKING METHOD

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## Introduction

Recently, carbon materials are studied as the effective sorbent for the heavy oil. It was previously reported that exfoliated graphite and carbonized fir fibers were able to sorb a large amount of heavy oil[1,2]. They have remarkable characteristic for oil sorption. The former has high selectivity for oil and the latter has an excellent recycling ability. In the present work, sorption kinetics of heavy oil into carbon materials was evaluated by a concept of liquid suction into porous ceramics[3].

## Experimental

Commercial exfoliated graphite powder and fir fibers carbonized at 900ºC were used as porous carbon materials. A-grade heavy oil with a low viscosity was used as sorbate. The measurement of sorption behavior was carried out by wicking method[4], weighing of carbon materials fixed in the glass column during sorption process. The weight increase of carbon materials with different density was measured. Exfoliated graphite was packed in the glass column under different density (height: 10 mm). In the case of carbonized fir fibers, their lump with different density was prepared by compressing them before the carbonization (height: 15 mm).

According to Beltran et al.[3], the weight of liquid sorbed into porous material per unit area normal to direction of displacement ($m_s$) with time (t) was approximated by the equation of $m_s = K_s \cdot t^{1/2} + B$, where $K_s$ is "liquid suction coefficient". The $K_s$ was determined from the slope of the plot $m_s$ against $t^{1/2}$ at the beginning of the sorption.

## Results and Discussion

Some typical plots of $m_s$ against $t^{1/2}$ are shown in Fig.1. It is found that the rate of sorption is

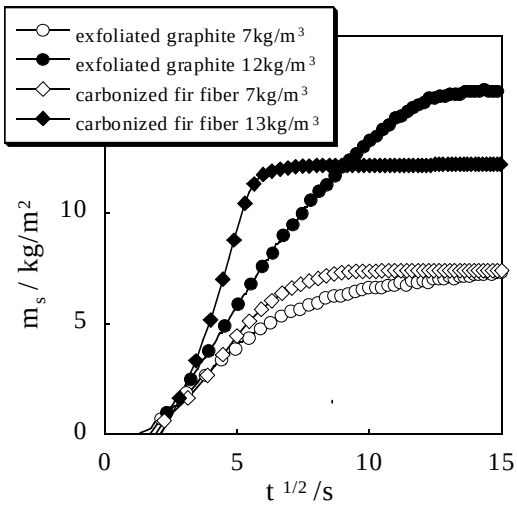


Fig.1 Sorption curves of A-grade heavy oil into exfoliated carbon and carbonized fir fiber with different densities.

dependent on the carbon materials and their density. In Fig.2, the dependence of the liquid suction coefficient $K_s$ on density of carbon material is shown. The $K_s$ of carbonized fir fiber is lager than that of exfoliated graphite. For exfoliated graphite, furthermore, the maximum $K_s$ is found around density of 15 kg/m$^3$. On the other hand, the $K_s$ of carbonized fir fibers increases with increasing the density.

It was known that the value of $K_s$ depended on pore structure of porous material and liquid property[3]. The "effective suction porosity" was determined from the ordinate broken away from the linear relation between $m_s$ and $t^{1/2}$ [3]. The dependence of effective sorption porosity on density of carbon materials is shown in Fig. 3. In a high density (> 10 kg/m$^3$), the carbonized fir fibers showed larger amount of effective suction porosity than the exfoliated graphite. From these results, it was suggested that the difference of effective suction porosity between carbonized fir fibers and exfoliated graphite was one of the causes of the difference of $K_s$.

## References


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## Acknowledgements


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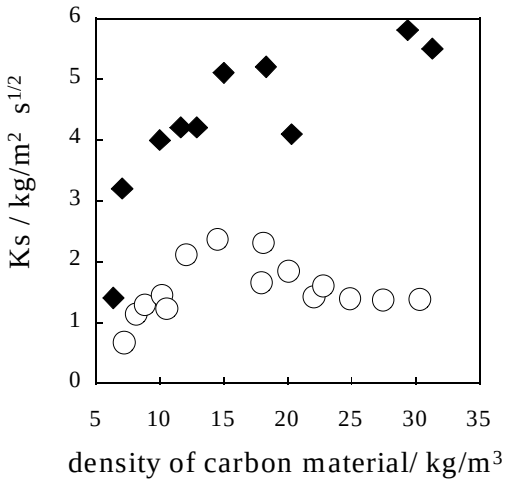


Fig.2 Dependence of $K_s$ on density of carbon materials. ○ : exfoliated graphite and ◆:carbonized fir fiber.

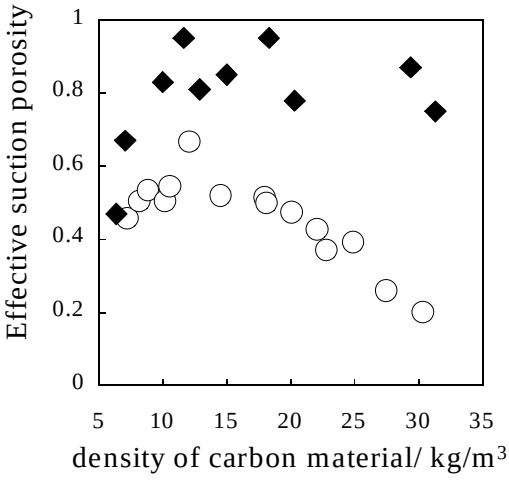


Fig.3 Dependence of effective suction porosity on density of carbon materials. ○ : exfoliated graphite and ◆ :carbonized fir fiber.