RECENT RESEARCH ACTIVITIES

Preparation and characterization of carbonized wood with metal ions for CO_2 capture

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In view of global warming, the adsorption and separation of CO_2 gas are necessary to prevent the further increase of its concentration in the atmosphere. The use of fossil fuels has increased in recent times, and there is a growing interest in developing CO_2-gas adsorption materials for applications not only in industries but also in offices and homes[1)]. Till date, the amine absorption method, active carbon method, and molecular sieve method are the most popular, which are suitable for capturing CO_2 gas emitted from industries on a large scale[2)]. For example, the amine absorption method is used for collecting large-scale CO_2 emissions from thermal power stations. However, after use, a substantial amount of energy is required to collect the amine solution and it cannot be used repeatedly for a long time. On the contrary, the adsorption process using solid solvents for capturing CO_2 gas is suitable for middle- to small-scale CO_2 gas emissions. Its applicability depends on adsorption efficiency and cost. The development of a retention method for the low-cost and effective adsorption of CO_2 is urgently required.

CO_2 gas can more easily access micropores (at approximately 2 nm, at 100 kPa atmospheric pressure), compared to nitrogen, as the CO_2-saturated steam pressure is lower, approximately 3.48 MPa at 273 K. Therefore, obtaining a good separation from a gas mixture is possible. Low- cost and low-pressure capture of CO_2 gas can be achieved through the adsorption process using solid solvents.

Wood is a porous material and is composed of two types of pores: macropores and micropores. Micropores already exist in the cell walls of dry wood (Fig.1)[3)]. The authors reported that onion-like carbon structures grow during conventional carbonization on wood[4)]. The carbonization of such a material may provide better access for CO_2 gas to these micropores. In the present activity, solid adsorbents from raw Todo fir material are developed at a low cost, in comparison with conventional products, for effective CO_2 gas adsorption. Furthermore, high resolution transmission electron microscopy (HRTEM) is used to observe the micropores' texture to explain the adsorption mechanism.

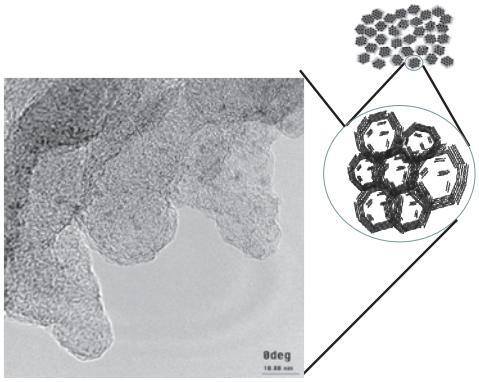

Fig.1 Formation of onion-like structures on wood obtained by heat treatment of wood[4)].

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