3 - 1 Zeolite synthesis and its application

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In this presentation, I will introduce a new continuous zeolite synthesis process that has been developed since 2001 as an industry-university cooperation project at the Research Institute of Sustainable and Environmental Technology, Waseda University. Zeolite is the group name of materials of microporous crystalline aluminosilicate having various useful physicochemical properties like selective adsorption, hydrophilicity, ion exchange property, and catalysis. These materials would possess a wide variety of possibilities to apply: Examples are agriculture, reclamation, cement and brick, stabilization of soil, building materials, improvement of week ground, artificial islands, hydrated fly ash, paint component with anti-corrosive property, defluorination from industrial wastes, desulfurization of flue gas, methylene blue removal, mercury removal, copper recovery from wastes, fixation of phosphates, chlorinated phenol removal and neutralization of acid wastes, cleanup of sewerage, heavy metal removal, and ammonium ion removal. While all industrial process for zeolite production have so far been batch hydrothermal processes, we have been attempting the development of a continuous zeolite production process for mass production of zeolite from coal fly ash. This process consists of four sections, raw materials preparation section, reaction section(1) for the dissolution of raw materials and partial crystallization, reaction section(2) for full crystallization, and product recovery section. A disk type reactor has been adopted for the reaction section (2), as shown in Fig.1. Since last year, various types of zeolite have successfully been synthesized by this bench-scale plant. Zeolite A, Y and X were formed from commercial chemicals and zeolite P, A and Y were produced from coal fly ash. A typical SEM image of A-type zeolite produced from fly ash is shown in Fig. 2. Crystalline materials involved in coal fly ash such as mullite and quartz cannot be converted into zeolite because such materials are not dissolved into alkaline aqueous solution. We, however, confirmed that glassy part of ash can be easily used for the production of zeolite. It was observed by using XRD, SEM, N_2 adsorption that the products was highly crystalline and high specific surface area. These results demonstrate that this continuous production process would enable us to produce zeolites in a larger scale from commercial chemicals as well as from coal fly ash.

Figure 1. Disk type reactor.

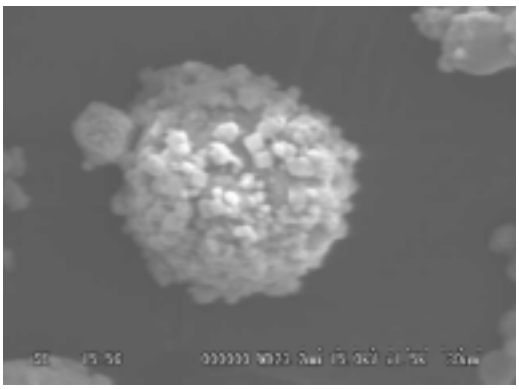

Figure 2. A typical SEM image of A-type zeolite produced from fly ash