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Preparation of Zeolite-metal Composite Membrane

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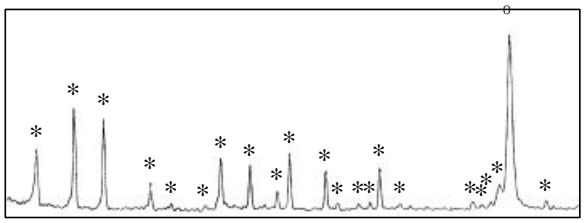
Abstract: A NaA zeolite membrane was synthesized on the surface of the stainless steel slab. The membrane was characterized by XRD and SEM. The membrane was continuous and highly intergrown. The size of NaA zeolite crystals was about 5 ~ 6 μm.

Keywords: NaA zeolite, membrane, XRD, SEM.

In recent years, zeolite membranes have gained hot attention due to their potential application in separation[1], catalysis[2], detection and chemical sensors[3]. Up to now, many types of zeolite membranes have been successfully synthesized on various supports such as alumina[4], glass[5], and copper[6]. In this report, a NaA zeolite membrane has been successfully formed on the stainless steel slab.

Before the synthesis, the steel slab (32 mm in width, 55 mm in length and 1.5 mm in thickness) was washed with water under ultrasonic vibration for 15 minutes. The solution for synthesis of membrane was prepared by mixing sodium hydroxide, water, aluminum foil and silica sol under vigorous stirring. The molar ratio of this solution is $SiO_2 : Al_2O_3 : Na_2O : H_2O = 5:1:50:1000$. The steel disk was placed at an angle of 15° to vertical direction with the help of a teflon holder in a stainless steel autoclave. The solution was poured to just immerse the steel slab. The crystallization was carried out at 90°C for 3 hours. After the synthesis, the composite membrane was washed and dried. Then the membrane was characterized by X-ray diffraction (XRD) on a Regaku D max/b powder diffractometer using Cu K_α (λ = 1.54 nm) radiation operating at 40 kV

Figure 1 The X-ray diffraction pattern of the zeolite NaA membrane: (*) zeolite NaA (o) steel



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and 50 mA and scanning electron microscope (SEM) on a JEM-1200E scanning electron microscope.

The XRD patterns of the membranes (**Figure 1**) are the combining peaks of the steel support (o) and the NaA zeolite (*). It can be concluded that many zeolite NaA zeolite crystals existed on the surface of the steel. The variation of the intensity of the diffraction patterns of the NaA zeolite is possibly caused by the orientation of the zeolite crystals on the steel surface. From the SEM images (**Figure 2**), it can be seen the surface of the steel support is completely covered with NaA zeolite crystals, the size of the zeolite crystals is about 5~6 μm and the crystals are grown in all directions and highly intergrown. The zeolite membrane was continuously and firmly bonded to the surface of the steel. Even after 20 min of vigorous ultrasonic vibration, the membrane remained well.

Figure 2 The SEM image of the zeolite NaA membrane

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