

Preparation of a compact microchannel membrane module for hydrogen purification

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This study investigates a compact Micro-channel-reactor (MCR) type membrane module assembled by the diffusion bonding method at the low-temperature (450 °C) for hydrogen purification. In order to perform the low-temperature diffusion bonding of the membrane module, the surfaces of SUS plates were modified with blasting, Ni-Cu deposition and thermal treatment in sequence, resulting in commissure dramatically increased the average-surface roughness (Ra) and surface-area. The surface modified plates made them well bonded at low-temperature. The prepared compact MCR type membrane module showed that the hydrogen flux was  $18.3 \text{ ml cm}^{-2} \text{ min}^{-1}$  at the pressure difference of 0.1 MPa with a  $\text{H}_2/\text{N}_2$  selectivity was over 1100. The hydrogen purification test using a 40%  $\text{CO}_2$ / 60%  $\text{H}_2$  mixture gas confirmed that the MCR type membrane module is capable of separating hydrogen with concentration of more than 99% at 400 °C, pressure difference 0.5 MPa and the feed gas rate of  $1.5 \text{ L min}^{-1}$ .