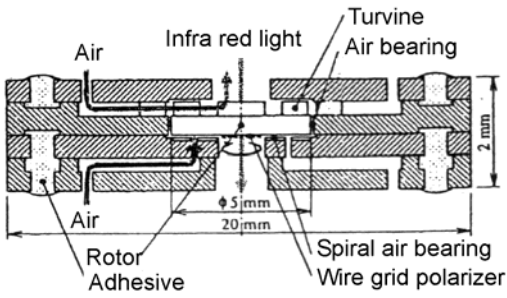
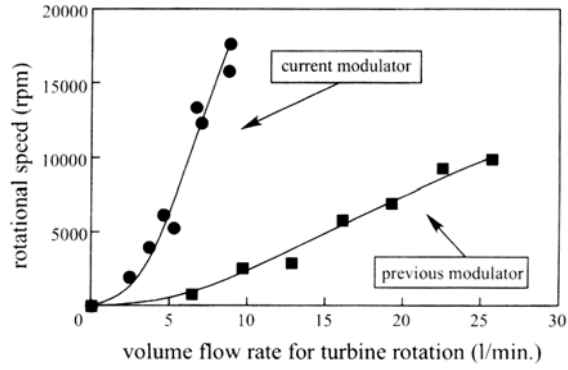


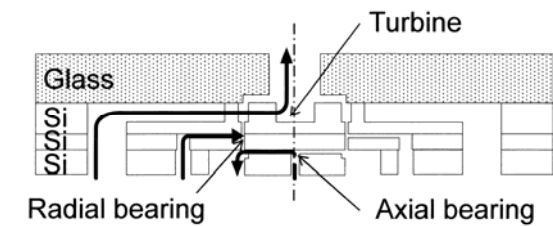
# Si Micro-turbine and Thermoelectric Generator



Si air-turbine for high-speed polarization modulator

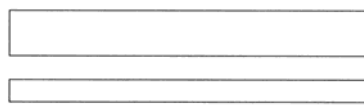


Reference : S.Tanaka, M.Hara and M.Esashi, Mechanical Polarization Modulator Using Micro-turbo Machinery for Fourier Transform Infrared Spectroscopy, Sensors and Actuators, A 96 (2002) pp.215-222



Si air-turbine with radial-inflow type journal bearing

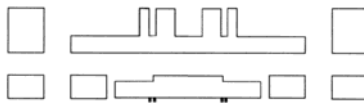
## 1) Preparation of 2nd and 3rd silicon wafer



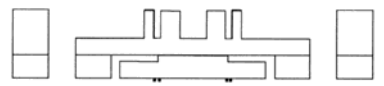
## 2) SiO<sub>2</sub> deposition, patterning and DRIE



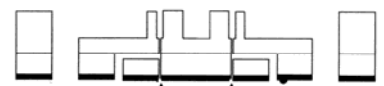
## 3) SiO<sub>2</sub> etching



## 4) Direct bonding

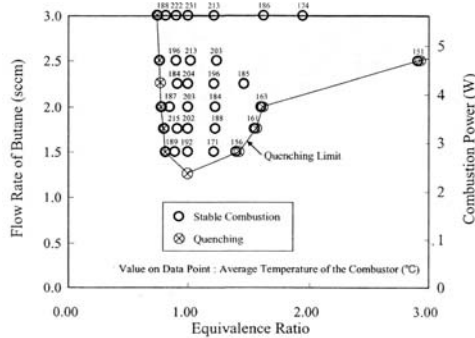
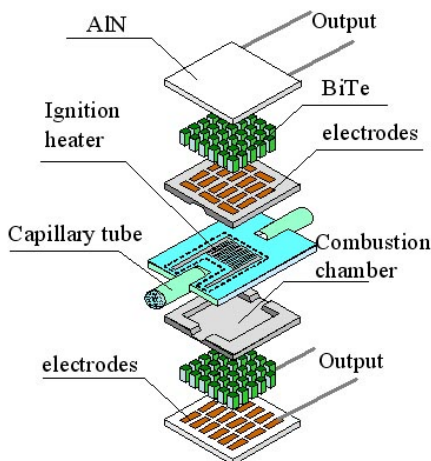


## 5) Photolithography and cavity-through DRIE

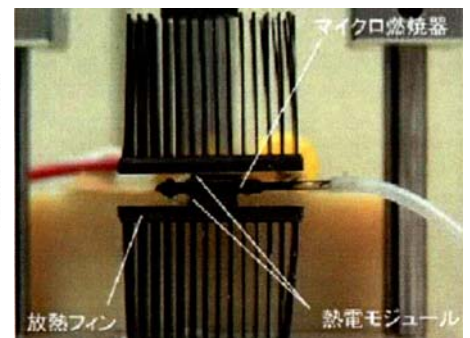
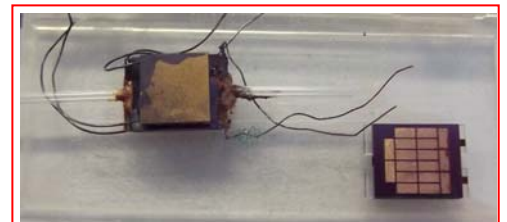


Cavity-through deep reactive ion etching

Reference : S.Tanaka, Y.Miura, P.Kang, K.Hikichi and M.Esashi, MEMS-based Air Turbine with Radial-inflow Type Journal Bearing, Trans. on Electrical and Electronic Engng. 3 (2008) pp.297-304



Thermoelectric generator



Reference : K.Yoshida, S.Tanaka, S.Tomonari, D.Satoh and M.Esashi, High-Energy Density Miniature Thermoelectric Generator Using Catalytic Combustion, J. of Microelectromechanical Systems, 15 (2006) pp. 195-203