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Development of high energy molecular beam source using ultra small shock tube NOBUYA MIYOSHI, YUTA YOSHIMOTO, IKUYA KINEFUCHI, KAZUYA SHIMIZU, SHU TAKAGI, YOICHIRO MATSUMOTO, Department of Mechanical Engineering, The University of Tokyo — The molecular beam technique is one of the powerful methods to investigate the gas-surface interactions in rarefied gas flows. The scattering experiment particularly with the beam translational energy over a wide range including the activation energies of surface reactions enables us to understand the phenomena in great detail. In order to generate the high energy beam in a range of 1 - 5 eV without any undesirable impurities, we have been developing a molecular beam source with a non- diaphragm type shock tube which can operate at a repetition rate high enough for efficient data acquisition. The volume of our shock tube is much smaller than that of conventional ones so that the evacuation time between each shot can be made as short as possible. The inner diameter of the shock tube is only 2 mm and thereby leads to the strong effect of the boundary layer on the acceleration and attenuation processes of shock waves. Hence we measured the shock Mach number as a function of the position along the tube to optimize the tube length. Finally we installed the shock tube in our molecular beam setup and measured the time- of-flight distributions of the shock-heated beams. These results suggest the design criteria for optimizing the molecular beam source with the adequate performance.

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