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High-Energy Molecular Beam Source Using a Non-Diaphragm Type Small Shock Tube YUTA YOSHIMOTO, NOBUYA MIYOSHI, IKUYA KINEFUCHI, KAZUYA SHIMIZU, SHU TAKAGI, YOICHIRO MATSUMOTO, The University of Tokyo — The molecular beam technique is one of the powerful tools to analyze gas-surface interactions. In order to generate high-energy molecular beam in a range of 1 - 5 eV, which corresponds to the typical activation energy of surface reactions, we are developing a beam source using a non-diaphragm type shock tube, which can operate at a repetition rate high enough for efficient data acquisition. We made the volume of a tube much smaller than that of conventional ones so that the evacuation time between each shot becomes as short as possible. Our measurement of shock Mach numbers showed that even small diameter (2 or 4 mm) tubes, in which the wall boundary layer has a large influence on the propagation of shock waves, could generate molecular beam with the translational energy of more than 1 eV. This is because the reduction of shock formation distance by rapid opening of the valve, which separates a high pressure room from a low pressure room, weakened the effect of viscous damping on the accelerating shock wave. In addition, the convergent shock tubes of which diameters linearly decrease from 4 to 2 mm exhibited higher Mach numbers than straight ones. This indicates that the application of the convergent tube with the optimized geometry would be promising for generating high-energy molecular beam.

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