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Metallization of selenium under shock compression SERGEY GILEV, Lavrentyev Institute of Hydrodynamics, Siberian Division of Russian Academy of Sciences — Time-resolved electrical conductivity measurements on solid and powder selenium are performed under shock compression followed by release. Measurement technique takes account of electromagnetic skin effect in conductive matter that allows one (unlike known schemes) to study dielectric-metal transition in single shock wave. Pressure dependence of the conductivity $\sigma(P)$ is obtained for amorphous selenium up to $30\,GPa$. With increasing the pressure the conductivity of selenium increases monotonically by 12 orders of magnitude. For $P < 20\,GPa$ the conductivity is of semiconductor nature. The conductivity data combined with temperature calculations give energy gap of compressed semiconductor selenium about 1.8 eV. For $P > 20\,GPa$ the conductivity shows pronounced saturation at $\sim 10^4\ Ohm^{-1}cm^{-1}$. Such large conductivity testifies to metallic state of selenium. Experiments with solid and powder specimens bring to light temperature effect on state of selenium. Metallization mechanism is polymorphic transition or melting (it depends on specimen density). The metallization transition goes without noticeable time delay. At the same time releasing pressure causes temporary conservation of the metallic phase that points to its metastable nature. Comparison of conductivity data obtained for two elemental semiconductors (selenium, silicon) reveals fundamental features of shock metallization and its principal distinctions from static metallization.

Sergey Gilev
Lavrentyev Institute of Hydrodynamics
Siberian Division of Russian Academy of Sciences

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