This thesis is devoted to a study of the conductivity of confined charge carriers in various nanocrystalline materials. The experimental method -- THz spectroscopy -- involves measurements of the conductivity of carriers generated by doping or by optical excitation. In the theoretical interpretation of measured data we address important aspects of carrier transport, connected to the microscopic inhomogeneity of samples and the nanoscale confinement of carriers. We focus on the study of nanocrystalline ZnO and CdS using simulations and experiments in a wide range of carrier densities and for several temperatures. In ZnO, the interplay of highly mobile electron-hole gas, dense electron-hole plasma and population of excitons was observed. In CdS the investigation reveals the importance of clusters of nanocrystals in the electron confinement. The dynamics of the electron mobility at different carrier densities show the role of the kinetic energy of electrons and its relaxation in the carrier transport in nanostructured systems. At temperatures 20 K and at low carrier densities a crossover between localized transport and Drude-like free electron behaviour was observed for the first time.