

**CRYSTAL CHEMISTRY AND CRYSTALLOGRAPHY OF THE TYPE-II
CLATHRATE, $\text{Cs}_8\text{Na}_{16}\text{Ge}_{136-x}\text{Ag}_x$, AND A NOVEL PHASE, $\text{Na}_{1-x}\text{Ge}_{3+z}$.**

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Type-II Clathrates such as $\text{Na}_x\text{Si}_{136}$, $\text{Na}_x\text{Ge}_{136}$ and $\text{Cs}_8\text{Na}_{16}\text{Ge}_{136}$ have great potential to be used as effective thermoelectric materials for power conversion and cooling applications. In this paper we will discuss two structures related to the type-II clathrates. Since doping of the framework Si or Ge sites with different elements could lead to enhancement of their thermoelectric properties, we have prepared a series of Ag-doped $\text{Cs}_8\text{Na}_{16}\text{Ge}_{136}$ phases. During the process of synthesizing $\text{Na}_x\text{Ge}_{136}$ using a vacuum decomposition technique, an unknown phase of Na-Ge was obtained. Two samples prepared using slightly different procedures were investigated using synchrotron, conventional x-ray, and neutron scattering (room-temperature as well as at 4K) techniques. This new phase was confirmed to have a zeolite-type framework that has open channels running through the structure. The general chemical formula of this new phase can be written as $\text{Na}_{1-x}\text{Ge}_{3+z}$. The structure of the Ag-doped $\text{Cs}_8\text{Na}_{16}\text{Ge}_{136-x}\text{Ag}_x$ phases obtained using single crystal x-ray diffraction method and the features of the structure of the novel $\text{Na}_{1-x}\text{Ge}_{3+z}$ phase will be summarized.