Determination of phase transition pressure in GaP

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Phase transformation of GaP is widely used as pressure fixed point in quench experiment. The purpose of the present study is to determine its transition pressure precisely based on the NaCl pressure scale. In order to clarify the effect of stress state in the sample chamber, three different types of cell assembly were prepared. Experiments were made at room temperature and at 200 °C using "SPEED1500" high-pressure and temperature in situ X-ray diffraction system at BL04. Transition of GaP was determined by measuring sharp drop of the electrical resistance. When GaP and NaCl were placed in the same plane of the sample chamber next each other, the transition was observed at 20 GPa. On the other hand, when GaP and NaCl was stacked and placed in the center of the sample chamber, the pressure value was 22 GPa. No meaningful difference of the transition pressure was observed when the same assembly was compressed isothermally at 200 °C. All these pressure values are lower than those reported earlier by cubic- [Yagi & Akimoto] or MA8- [Onodera & Ohtani] type multi-anvil apparatus and are close to the value determined by diamond anvil cell using ruby pressure scale [Piermarini & Block]. In the present experiments, the amount of GaP sample was much larger compared to the previous studies. This is because the transition of GaP was observed not only by the electrical resistance but also by the x-ray diffraction measurement. This may be one of the reasons why the transition pressure in the present study is slightly lower compared to the previous results obtained by multi-anvil apparatus. These results suggest that the stress state in the sample chamber affects a lot to the observed transition pressures. In order to obtain reliable transition pressure value of GaP as a pressure fixed point, further detailed studies are required.