PCOS and phase-change alloys, GeSbTe

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ABSTRACT

The first part of my talk will present "what has PCOS been?" for new participants who are expected to be familiar with this meeting from now. The history of PCOS has mostly coincided with the period in which superior phase-change alloys, such as GeSbTe (1987) and AgInSbTe (1992), were proposed and have been applied to DVDs (2000~) and Blu-ray Discs (2003~) to create a new culture from Japan. In the meanwhile, many researchers (mainly from private companies) have cooperated beyond the fence of organizations to complete the phase-change memory technologies. The very familiar atmosphere brewed there has been the fine and unique merit of PCOS.

In this decade, main themes in the phase-change material field have tentatively shifted from the industrial device developments to the academic fundamental researches around the unique/interesting characteristics of phase-change materials. They are, for example, 1) compatibility of the pico-nano seconds crystallization and over several decades amorphous stability, 2) possibility of non-melting amorphization, 3) origin of the rapid/large optical change, 4) principle of interfacial PCM, 5) origin of the small thermal conductivity, 6) magnetic properties and so on.

As the second part, a very initial atomic motion in the cubic GST225 just after femtosecond laser irradiation will be presented to discuss some of the above issues. According to our pump (laser)-probe (XFEL) analysis, Ge atoms in the Te octahedron do not move away to 111 directions but start to move around the center with exhibiting a rattling-like motion just after pumping. [1] This motion can explain well the abrupt optical change by being combined with the resonant bonding model. It can also well explain the amorphous structures shown in many previous reports, and eventually suggest the possibility of non-melting amorphization.

[1] N. Matsubara et al., *Phy. Rev. Lett.* in press (2016).

Key words: PCOS, Phase Change, GeSbTe, rattling motion.