# Anisotropic elasticity in Eu doped strontium aluminate phosphor

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Mechanoluminescent material of $SrAl_2O_4:Eu^{2+}$ (SAO-E) phosphor emits an intensive green luminescence when a mechanical stress is induced in a solid. We have proposed that this phenomenon can be applied to a transducer for multiple energy conversions among electrical-mechanical-light and try to develop a stress-sensing devise using this material. The mechanical property in SAO-E is important for understanding this extraordinary luminescent behaviour and therefore a detail investigation on the elastic property is needed. The purpose of the present study is to clarify the elastic property of SAO-E from a microscopic view.

We have examined the temperature dependence of the lattice constants in SAO-E by Rietveld analysis with synchrotron X-ray powder diffraction data at different temperatures and calculated the linear expansion coefficients. This experiment is suited for investigating hardness of a solid if it has a complex crystal structure such as SAO-E that is monoclinic.

The temperature dependences of the lattice constants $a$, $b$, $c$, and $\beta$ normalized by ones at 100 K are shown in Figure 1. Apart from the $\beta$, all lattice constants linearly increase with the increasing of temperature. However, it should be noted that the expansion coefficient in $c$ is significantly smaller than that of others. The experimental results indicate that SAO-E has an anisotropic property on the elasticity.

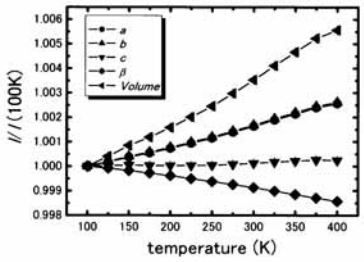


**Figure 1 The temperature dependence of the normalized lattice constants.**



# X-ray diffraction of Magnesium Fullerides

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Magnesium fullerides $Mg_xC_{60}$ are expected to show a wide variety of physical properties by controlling a doping level widely, since $Mg^{2+}$ has a small ionic radius and a number of $Mg^{2+}$ ion can intercalated into voids of $C_{60}$ crystals. We have prepared $Mg_xC_{60}$ (x=4, 5 and 6) and studied their structural and physical properties. These three phases were found to have a similar rhombohedral structure. The crystal structure of $Mg_4C_{60}$ were reported to be a rhombohedral structure with a=b=0.922 nm, c=2.525 nm and $\gamma$ =120° based on two-dimensional polymeric sheets of $C_{60}$ ions[1]. The purpose of this study is to examine the structure of $Mg_xC_{60}$ and check the structural change expected to show polymer to monomer transformation.

The mixture of $C_{60}$ powder and Mg metal were introduced into a stainless steel tube in Ar globe box and then sealed into a Pyrex glass tube after evacuating. It was heated at 450°C for hundreds hours. The molar ratio x was estimated by weight uptake. The X-ray diffraction measurement was performed using synchrotron radiation source on BL02B2 at SPring-8. Figure 1 shows the temperature dependence of the x-ray powder diffraction profiles for $Mg_6C_{60}$ with heating from 300K to 750K and cooling to 300K.

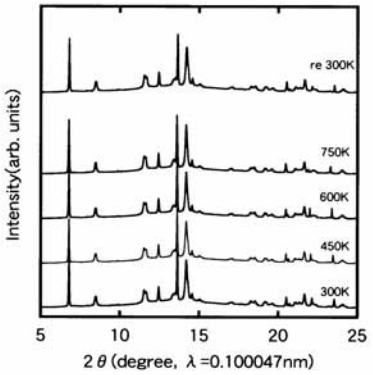


Fig.1 Temperature dependence of the x-ray diffraction profiles for $Mg_6C_{60}$ between 300K and 750K.

At starting 300K, All peaks can be assigned to a rhombohedral structure with a=0.92246 nm, c=2.5286 nm and $\gamma$=120°. The structure change was not observed between 300K and 750K. Detailed structural analyses are in progress.

References

[1] F.Borondics et al., Solid. State. Commun. 127, 311-313(2003).