Direct observation of Au-Au interaction in the Au complex with Reversible Mechanochromic Luminescence properties.

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1 Introduction

The Au complex 1 shows unique optical property. The Complex 1 shows blue color luminescence in a crystalline form when black light (365 nm) is illuminated. On the other hand the luminescence color changed to yellow after the grinding. When the ground powder is treated with a dichloromethane droplets, the blue luminescence is recovered.1 Hypothesis of the origin of the color change is the reversible formation of intermolecular Au-Au bond at aurophilic bonding length region (2.7-3.3 Å). We had tried to detect this Au-Au distance by EXAFS but failed to observe it clearly, probably due to the thermal disorder. Actually the complex 2 with Au-Au distance at 3.32 Å shows little peak at 100 K as shown in Fig.1. We decided to carry out much lower temperature studies in order to reduce the thermal vibration. We have used a He cryostat to obtain XAFS data measured at 4 K where we can obtain the Au-Au peak clearly.

2 Experiment

Fig.2 shows the He Cryostat (JANIS STVP-100) modified to X-ray absorption spectroscopy.

The sample was cooled to 4 K within 1 hour. The temperature can be controlled by a heater and liquid He flow rate within the precision of less than 1 K.

3 Results and Discussion

Fig.3 shows Fourier transform of Au complex 2 measured at 4 K. The peak corresponding to the Au-Au clearly appeared at 3.2 Å. The curve fitting analysis showed that the Au-Au distance = 3.38 Å well corresponding to the crystal data of Au-Au = 3.31 Å. We can conclude that the low temperature measurement tremendously decreases the thermal vibration and observe the weak Au-Au interaction. We are now challenging to elucidate Au-Au interaction in compound 1.

![Fourier transform for complex 2 at 100 K.](image1)

![He Cryostat for the XAFS measurement](image2)

![Fourier transform for 2 at 4 K](image3)


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