Introduction
Solid lubricant MoS$_2$/Ti composite coating which is registered as MoST™ can be used to protect machine tools against wear and so extending the tool’s lifetime. MoST™ shows different mechanical properties as Ti concentration in the coating. In addition, the structure and mechanical properties of MoST™ is supposed to change dependent on the working temperature, so the structure and mechanical properties after heat-treatment in vacuum were investigated in this work.

Experiments
All coatings were produced with a dc magnetron sputtering system. The Ti concentration of the coatings was changed by the current of Ti magnetron. Coatings were deposited with the current of Ti magnetron of $I(Ti) = 0A, 0.5A, 1.0A, 1.5A$, and $2.0A$. The structure of the coating was analyzed by x-ray diffraction(XRD) method using Cu-K$_\alpha$ radiation. Concentration of Ti in the coating was examined by energy disperse spectroscopy(EDS). The morphology is examined by scanning electron microscopy(SEM).

Results and Discussion
Fig. 1 shows the XRD patterns for heat-treated MoST™ coatings. This figure shows that MoST™ coatings were micro- or macro-crystallized and Ti was separated from the coating if the heat-treatment temperature was higher than 500°C.

![Figure 1. XRD pattern of MoST™ coating(X(Ti)=16at%) after heat treatment for 1 hour in vacuum.](image)

According to the rough surface, friction coefficient might be increased, and other mechanical properties might be varied. Fig. 3 shows the dependence of the elastic modulus and hardness of MoST™ coating ($X(Ti)=16at\%$) on the heat treatment temperature. The hardness increases by vacuum heat-treatment, but it decrease again if the heat-treatment temperature is above 500°C.

![Figure 3. Dependence of the Elastic Modulus and Hardness of MoST™ coating(X(Ti)=16at%) on the heat treatment temperature.](image)

Conclusion
MoS$_2$/Ti composite coatings were micro- or macro-crystallized if the heat treatment temperature was higher than 500°C. It resulted in the increase of porosity and decrease of hardness of the coating.

References: