Shinji Kobayashi et al., J Astrophys Aerospace Technol 2017, 5:2 (Suppl)
DOI: 10.4172/2329-6542-C1-009

Isotope shift of Ti spectrum in a facing target sputtering system

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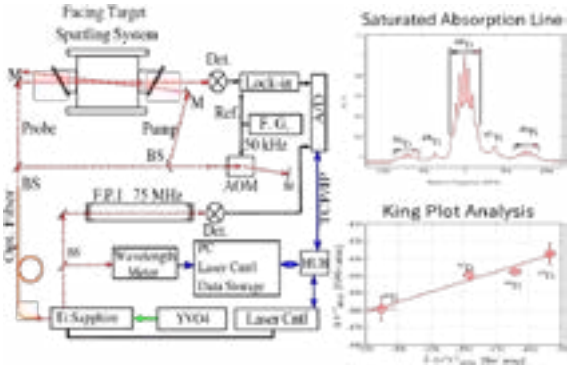
Laser spectroscopy is one of the useful methods of plasma diagnostics. In order to measure the plasma density and temperature, parameters of the line profile of the spectrum need to be determined. In this study, we measured the absorption spectrum of Ti atom in a facing target sputtering (FTS) system by using a Ti: sapphire laser. It is difficult to determine the parameters of the line profile of the Ti spectrum, because Ti has five stable isotopes and hence the spectra are complicated. The saturated absorption spectrum in $3d^24s^2 \rightarrow 3d^24s4p$, $3d^34s \rightarrow 3d^24s4p$, and $3d^34s \rightarrow 3d^34p$ electronic transitions of neutral titanium in the FTS system were measured in the range from 695 to 1005 nm. The even mass isotope shifts of ^{46}Ti and ^{50}Ti for ^{48}Ti have been measured. The accuracy of absolute frequency of the Ti spectra was 0.001 cm^{-1}. The King plot analysis was performed for those transitions. The specific mass shift of Ti I is much larger than the field shift. The several energy levels belonging to $3d^34p$ interact with those of $3d^24s4p$. The specific mass shift of $3d^34p$ depends on the contribution from $3d^24s4p$. The relationship between the interaction and the specific mass shift is linear. The specific mass shift of the levels belonging to $3d^24s4p$ and $3d^34p$ can be semi-empirically determined.



Biography

Shinji Kobayashi is doctoral student in Japan. He is majoring in the department of electronics and information Technology. He is researching about atomic or molecular spectroscopy.

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