DDCS of e-emission from CH_4 upon impact with 3.5 MeV/u bare silicon ions

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Synopsis We present the experimental study of electron emission from methane (CH_4) in collisions with 3.5 MeV/u bare $Si^{14=}$ projectiles. We have measured double differential cross section (DDCS) of electron emission and compared the data with the CDW-EIS model calculation. The motivation of such study is to have a reference data set to compare with those for PAH molecules, such as, coronene ($C_{24}H_{12}$).

The measurement of double differential cross section (DDCS) of e^--emission in ion-atom/molecule collision provides stringent test to theoretical frameworks. Mostly smaller atomic targets with less number of electrons are commonly used in such study. However, there is increasing demand to study the interaction of ions with large molecules owing specific application, such as, nucleo-bases for radiation therapy[1,2], and PAH molecules (e.g. coronene-$C_{24}H_{12}$) for its importance in astrochemistry [3,4]. Hence the study with small molecules upon ion impact is important and serve as intermediate step in order to extend the model calculations for larger molecules.

In the present study we have measured DDCS of e^--emission from CH_4 molecule upon 3.5MeV/u Si^{14+} ion impact. The secondary electrons have been energy analyzed and detected using hemispherical electron energy analyzer coupled with channel electron multiplier. The spectrometer is mounted inside the high vacuum chamber on a rotatable turntable. The measurements have been carried out in the electron energy range of 1 - 400 eV and angular range of 20^0 to 160^0.

Energy and angular distribution of electron emission have been compared with the prior form of the continuum distorted wave-eikonal initial state (CDW-EIS-prior) model calculations. The Fig. 1 shows the energy distribution of electron emission at an angle of 45 degrees. The carbon KLL-Auger peak is observed around 240 eV. The calculations gives an overall good agreement, although slightly overestimating in the low e^- energy 30 eV. The study in the case of 3.5 MeV/u bare Si ions provides the stringent test to the model as the perturbation strength is large. The detailed results of comparisons of measured and calculated cross sections and discussions will be presented.

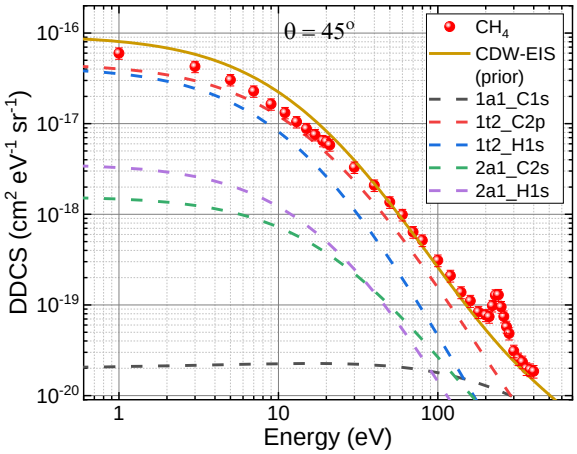

Figure 1. Energy distribution electron emission from CH_4 upon 3.5 MeV/u Si^{14+} ion impact at 45^0. The solid line: total DDCS from CDW-EIS and dashed lines represents individual molecular orbital contributions.

References

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