

Electron-DDCS Measurements of Water by C and Si Ion beams

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Synopsis Double differential distributions of electron emission from H₂O target under the impact of C⁶⁺ and Si¹³⁺ ions with energy 4 MeV/u have been measured. The state-of-the art CDW-EIS model provided a good agreement with the data for C-ions whereas a substantial deviation is found for the Si ions. The derived single differential cross sections and total cross sections were also compared with different models.

Interaction of highly charged ions with water molecules is of great importance in many areas including radiation therapy. Proton and carbon therapy are the most widely used techniques for treating cancer cells. Since water constitutes about 60% of the body it is important to understand the heavy ion collisions with this molecule in order to help modelling the radiation therapy. Most of the earlier investigations on ionization of water molecules use proton and He-ions [1-3]. Very few measurements have been reported so far regarding interaction of water [1-5] or other biomolecules [6-8] with other heavier ions

We have measured the double differential cross section (DDCS) of electron emission from a free water molecule under the impact of (4 MeV/u) C⁶⁺ and Si¹³⁺ ions at same velocity i.e. at energy 4 MeV/u. The ion beams were obtained using a 14 MV Pelletron tandem accelerator facility at TIFR, Mumbai. The angular and energy distributions of the e-DDCS were investigated over a wide energy region i.e. 1-600 eV to include the KLL Auger peak. The angular range was chosen to be between 20 and 160 degree. The single differential cross sections and total cross sections were also calculated. The measured cross sections were compared with the CDW-EIS (prior version) model. The calculated cross sections exhibit very good agreement with the theoretical model for C-ions [see Figure 1(a)]. A similar agreement was also reported by us in case of fast bare oxygen ions of energy 6 MeV/u [5]. The deviation starts for the H-like Si ions [Fig 1(b)], which clearly tests the limit of validity of the model w.r.t atomic no. of projectiles as well as perturbation strength. A strong dependence

of the projectile nuclear charge on the cross sections were seen by comparing the results of C⁶⁺ and Si¹³⁺ beams. The detail results will be presented along with earlier existing results.

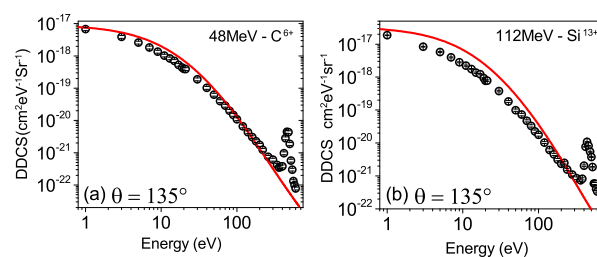


Figure 1: DDCS as a function of ejected electron energy for C⁶⁺ (a) and Si¹³⁺ (b) ions. In each plot, the solid red line corresponds to the CDW-EIS prior version

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