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The K-shell electron impact ionization (EII) cross section, along with the K-shell fluorescence yield, is one of the key atomic parameters for fast-electron diagnostic in laser-solid experiments through the K-shell emission cross section. In addition, in a campaign dedicated to the modeling of the K lines of astrophysical interest \cite{Palmeri12}, the K-shell fluorescence yields for the K-vacancy fine-structure atomic levels of all the vanadium isonuclear ions have been calculated.

In this study, the K-shell EII cross sections connecting the ground and the metastable levels of the parent vanadium ions to the daughter ions K-vacancy levels considered in Ref. \cite{Palmeri12} have been determined. The relativistic distorted-wave (DW) approximation implemented in the FAC atomic code has been used for the incident electron kinetic energies up to 20 times the K-shell threshold energies. Moreover, the resulting DW cross sections have been extrapolated at higher energies using the asymptotic behavior of the modified relativistic binary encounter Bethe model (MRBEB) of Guerra \textit{et al.} \cite{Guerra12} with the density-effect correction proposed by Davies \textit{et al.} \cite{Davies13}.

References