View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Biblioteca Digital da Produção Intelectual da Universidade de São Paulo (BDPI/USP)

Universidade de São Paulo

Biblioteca Digital da Produção Intelectual - BDPI

Departamento de Materiais e Mecânica - IF/FMT

Comunicações em Eventos - IF/FMT

2013-05-20

Stopping power and depth dose profile of H+ and He+ ion beams in hydroxyapatite thin films.

Nano-IBCT Conference, 2nd., 2013, Sopot.
http://www.producao.usp.br/handle/BDPI/44659

Downloaded from: Biblioteca Digital da Produção Intelectual - BDPI, Universidade de São Paulo

Stopping power and depth dose profile of H^+ and He^+ ion beams in hydroxyapatite thin films

P. de Vera[1], S. Limardi[2], R.C. Fadanelli[3], L.C.C.M. Nagamine[4], A. Mello[5], I. Abril[1], M. Behar[3], R. Garcia-Molina[6]

[1]*Departament de Física Aplicada, Universitat d'Alacant, E-03080 Alacant, Spain*
[2]*Centro Atómico Bariloche, RA-8400 San Carlos de Bariloche, Argentina*
[3]*Instituto de Física, Universidade Federal do Rio Grande do Sul, Porto Alegre, 91501-970, Brazil*
[4]*Instituto de Física, Universidade de São Paulo, 05508-090, São Paulo, Brazil*
[5]*Centro Brasileiro de Pesquisas Físicas, Rua Dr. Xavier Sigaud, 150, Rio de Janeiro, 22290-180, RJ, Brazil*
[6]*Departamento de Física – CIOyN, Universidad de Murcia, E-30100 Murcia, Spain*
Corresponding author: pablo.vera@ua.es

Hadron therapy is a promising technique to treat deep-seated tumors. For an accurate treatment planning, the energy deposition in the soft and hard human tissue must be well known. Water has been usually employed as a phantom of soft tissues, but other biomaterials, such as hydroxyapatite (HAp), used as bone substitute, are also relevant as a phantom for hard tissues. The stopping power of HAp for H^+ and He^+ beams has been studied experimentally and theoretically. The measurements have been done using the Rutherford backscattering technique in an energy range of 450-2000 keV for H^+ and of 400-5000 keV for He^+ projectiles. The theoretical calculations are based in the dielectric formulation together with the MELF-GOS (Mermin Energy-Loss Function – Generalized Oscillator Strengths) method [1] to describe the target excitation spectrum. A quite good agreement between the experimental data and the theoretical results has been found. The depth dose profile of H^+ and He^+ ion beams in HAp has been simulated by the SEICS (Simulation of Energetic Ions and Clusters through Solids) code [2], which incorporates the electronic stopping force due to the energy loss by collisions with the target electrons, including fluctuations due to the energy-loss straggling, the multiple elastic scattering with the target nuclei, with their corresponding nuclear energy loss, and the dynamical charge-exchange processes in the projectile charge state. The energy deposition by H^+ and He^+ as a function of the depth are compared, at several projectile energies, for HAp and liquid water, showing important differences.

Acknowledgments: work financially supported by the Spanish Ministerio de Economía y Competitividad and the European Regional Development Fund (Project FIS2010-17225), the Conselleria d'Educació, Cultura i Esport de la Generalitat Valenciana (VALi+d program) and the European COST Action MP-1002, Nano-IBCT.

References

[1] S. Heredia-Avalos, R. Garcia-Molina, J. M. Fernández-Varea, I. Abril, *Phys. Rev. A* **72**, 052902 (2005)
[2] R. Garcia-Molina, I. Abril, S. Heredia-Avalos, I. Kyriakou, D. Emfietzoglou, *Phys. Med. Biol.* **56**, 6475 (2011)