中国科学院
固体物理研究所

# 学术报告(2013-6-4)

**Title:** Modeling Cascade Effects in Kinetic Theories of Neutron Damage

**Lecturer:** Prof. C.H. Woo

Department of Physics and Materials Science, City University of Hong Kong

**Time:** 3:00p.m., Tuesday, June 4, 2013

**Place:** Room 321, main building of Institute of Solid

## Abstract:

Damage by fast neutrons takes the form of “local explosions” reaching very high temperatures. As the damaged region cools down, lattice defects are “quenched in”, resulting in near-simultaneous creation of a large number of atomic displacements in a small cascade volume. This mode of creation of displacement damage has two characteristics that need to be accounted for in a kinetic model of irradiation damage. Firstly, extensive annealing occurs, which only allows a small fraction of the initial displacements to survive as vacancies and interstitials and their clusters. These constitute the primary damage. Through the introduction of production bias, it was already shown in Silkeborg (1989) that the macroscopic manifestation of the damage effects depends almost completely on 3 parameters characterizing the primary damage. To obtain a quantitative description of these parameters naturally becomes the objective of investigation of many recent studies on cascade initiation. Indeed, to relate the primary irradiation damage to the neutron energy spectra is obviously a crucial first step in correlating irradiation damage among different irradiation facilities for design and regulatory functions.

A second characteristic of cascade damage is the strongly correlated point-defect production in discrete packages. As a result of the random nature of cascade initiation, strong stochasticity is introduced into the arrival and annihilation of point defects at sinks. It is intuitively clear that fluctuations are of primary importance in processes such as the evolution of in-cascade clusters, the nucleation of voids and interstitial loops. The identification of relevant parameters to characterize cascades in this regard is also needed to complete the research on Primary Radiation Damage from nuclear reaction to point-defects.

How these effects can account for in the modeling of cascade-produced irradiation damage is a crucial step to allow the correlation of irradiation effects measured in different irradiation facilities, or in reactors of the same type but between different locations. In this talk, we will give a brief account of our research in this area.

## Short CV for Chung Ho Woo

胡仲豪教授本科毕业于香港大学数学系，获加拿大Waterloo大学理论固态物理学哲学博士,加入加拿大原子能研究院AECL，从事核堆研究工作22年,期间是燃料管道、轻离子加速器辐射模拟部的主管和首席专家,抗变压力管的委员会主席。1996年回港，加入香港理工大学，历任机械工程学及固态电子学讲座教授，2000年获颁香港大学理学博士,2013年获选香港工程科学院院士。现任城市大学核工程学讲座教授,领导有关工程领域的科研教学与顾问。

胡教授是多尺度多物理材料建模的先驱之一,研究领域涵盖计算材料学，辐照损伤理论和铁电薄膜结构。曾任美国DOE专家評委,IEA国际能源协会評委,加拿大研究讲座撥款专家評委,IAEA专家評委。香港特区大学研究活动评委，特区研究撥款評委，特区专上教育发展委员，工程师学会核能部主席，大亚湾应变计划检讨专家咨委,香港城市大学核能与风险工程课程評委,香港学者协会副主席,工程师学会核能部高级技术顾问。

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