Studies on the damage factor mean using two different kinds of radiation source: pulsed plasma and pulsed laser

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Abstract

One of the pressing problems in the design and construction of nuclear fusion reactors is the selection of candidate materials for its plasma facing components. The essential constraint is that such a material has to be able to withstand extreme heat fluxes, together with high fluxes of neutrons, ions beams, and He and H isotopes such as deuterium.
The time of interaction, peak power and deposited energies on materials in inertial and magnetic confinement differ. However, it has observed that radiation sources producing high power flux Q with a short time interaction τ on a specific material, have the similar thermomechanical effects if the material is irradiated with a source with less Q and longer τ, if in both situation the damage factor F has the same value. The damage factor, F, is an empirical parameter that has been recognized that a good measure of the damage in an irradiated sample. F is defined as $Q\sqrt{\tau}$ (with Q the power flux and τ the time of interaction with the material). The damage factor F reach values as high as ≥ 70 ($MWm^{-2}\ s^{1/2}$) for both, magnetic confinement experiments (like ITER), and inertial confinement experiments (like NIF) [1].
It is notice that the damage factor does not depend of the kind of the irradiation, and recently a theoretical explanation of the damage factor has been proposed [2].
In this work, an experimental study to contribute to understanding of the damage factor mean, and oriented to obtain a calibration of the produced damage factor by a table top plasma focus device [3] to be used in the characterization of plasma facing materials for nuclear fusion reactors [4], is presented. Two different kind of radiation source, pulsed plasma and pulsed laser, are used ranging values of F from 10 to 1000 ($MWm^{-2}\ s^{1/2}$).
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Referencias

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