Computer Simulation of Thin Stripper Target Behaviour Under Bombardment of Intense Pulsed Ions

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I. INTRODUCTION

The problems of stripper target behavior in the nonstationary intense particle beams are considered. In the report I try to describe the experimental behavior of foil in the conditions of Brookhaven National Laboratory (BNL) linac.

II. HISTORICAL SKETCH OF STUDYING THE BEHAVIOR OF CARBON TARGETS UNDER ION BOMBARDMENT

The different approaches to quantitative estimations of the lifetime of carbon stripper targets are described in the historical scale.

III. INFLUENCE OF RADIATION DAMAGE ON THE FOIL LIFETIME

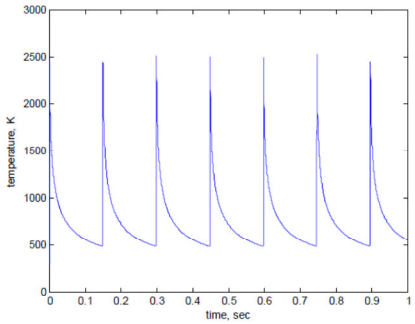
The influence of radiation damage on stripper foil lifetime is related with the point radiation defect accumulation giving rise to deformation of crystal lattice and mechanical destruction of foil.

IV. EVAPORATION OF A TARGET BY AN INTENSE PULSING BEAM

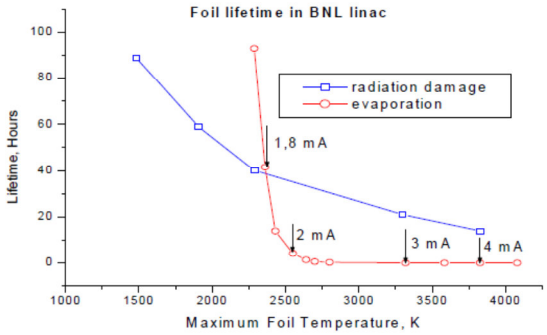
Consideration of temperature field of foil under bombardment by nonstationary intense particle beams giving rise to its evaporation produces the couple of differential equations related the temperature and the thickness of foil which has been solved by means of numerical computer simulation.

V. RESULTS OF CALCULATION AND DISCUSSION

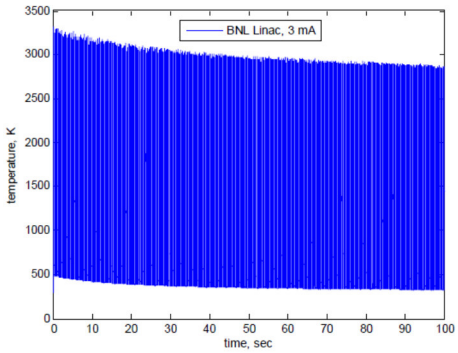
Lifetimes of stripper targets under intensive nonstationary beams can be described by two failure mechanisms: radiation damage accumulation and evaporation of a target. At the maximal temperatures less than 2500K the radiation damage dominates; at temperatures above 2500K the mechanism of evaporation of a foil prevails.



A temperature field of a BNL linac target in the first second of work at a pulse current 2 mA .



Calculated dependences of lifetime of BNL linac foil due to processes of radiation damage and evaporation.



Deformation of a temperature field in a target of BNL linac, caused by the reduction of thickness of a foil due to its evaporation.