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A review of radiation-induced demagnetization of permanent magnets

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Abstract:

Radiation-induced demagnetization of permanent magnets is important for a number of applications including space missions, particle accelerators and for robots designed to carry out rescue missions at nuclear accidents where magnet failure can lead to serious consequences. This topic has been studied by several investigators over the past three decades and in this paper, a review of the available literature is conducted and some general conclusions and trends are presented. In short, it can be gleaned that the magnetism loss is dependent on the type of radiation, the energy of the incoming particle and the overall dose or fluence. Furthermore, the magnetism loss also shows a dependence on the type of the irradiated magnet, and the coercivity of the magnet, the demagnetizing field and the temperature of irradiation.

Introduction

Neutrons, electrons, protons, ion beams, gamma rays and other types of radiation may alter the properties of a permanent magnet causing demagnetization. The desire of researchers to better establish a fundamental understanding for the phenomenon of radiation-induced demagnetization of permanent magnets (PMs) has been fueled in part by the need for better radiation-resistant magnets in a variety of applications. The modification of the magnetic field due to irradiation may have serious consequences in some applications such as in NASA space missions [1, 2],