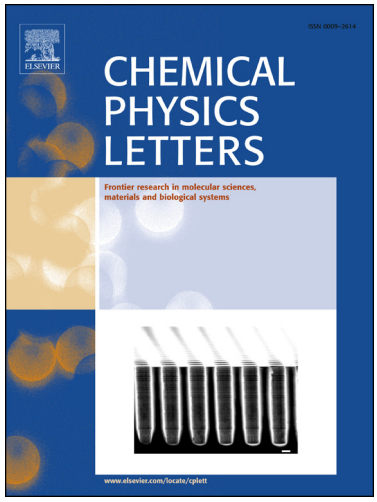

Ionization cross section of radicals produced by hexamethyldisiloxane dissociation

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Ionization cross section of radicals produced by hexamethyldisiloxane dissociation.

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Abstract

The ionization cross section of hexamethyldisiloxane (HMDSO) molecules (m/z=162), pentamethyldisiloxane radicals (m/z=147) and tetramethyl hydro disiloxane radicals (m/z=133) have been measured versus electron energy up to 30 eV. The radicals are produced selectively by two different mechanisms which are the energy transfer by collision with metastable argon species and the VUV photolysis. The absolute ionization cross section values are determined and analytical functions derived from the Binary-Encounter-Bethe theory (BEB) are given to calculate the direct ionization of molecules or radicals versus electron energy lower than 30eV.

1. Introduction

The hexamethyldisiloxane (HMDSO) monomer is an organic silicon compound composed of six methyl radicals bound to a siloxane group. Its formulation is (Si_2OMe_6). This compound was first used in the composition of heat resistant adhesives [1]. Nowadays, with the development of plasma technologies, it is used for patterning thin film layers for many mechanical or optoelectronic applications, as insulating barrier or low k dielectric material [2-6].

In a plasma discharge, the molecules or radicals are dissociated or ionized in electron-impact processes that produce ions and other radicals. The ionization processes of molecules or atoms have been largely studied in the last century and still today. However, the studies about the electron-impact ionization of radicals are scarce in the literature, because of the difficulty to select and to study these reactive species. The knowledge of the cross section values is necessary to model and to understand the plasma processes in low energy electron “cold” plasmas [7-10]. The purpose of this work is to measure the electron-impact ionization cross sections of the free neutral radicals produced by a selective dissociation process of