Pramāṇa – J. Phys., Vol. 30, No. 6, June 1988, pp. 549–555. © Printed in India.

A simple technique for laser-induced ablation pressure measurement

T S SHIRSAT, N S SHIKHARKHANE and H C PANT
Laser Division, Bhabha Atomic Research Centre, Bombay 400085, India

MS received 13 November 1987; revised 11 February 1988

Abstract. A simple method for measuring laser-induced ablation pressure is described. The technique utilizes the well-known double foil concept. In the present experiment the impact times were estimated by monitoring the reflectivity of the impact foil rear. The measurements were performed using a glass laser (1·06 μm wavelength) in the 10^{11}–10^{13} W/cm^2 irradiance range. Experimental results showed good agreement with those obtained using other techniques as also those with the self-regulating ablation model prediction.

Keywords. Double foil; impact time; probe beam reflectivity; laser-induced ablation pressure.

PACS No. 52·50

1. Introduction

Fuel compression along a low adiabat is one of the important requirements of laser-induced fusion (Nuckolls *et al* 1972). High fuel compression can in principle be achieved by symmetrically imploding a spherical pellet containing fusionable material (Nuckolls *et al* 1972). High pressures needed for pellet implosion can be obtained by laser-induced ablation of the pellet surface (Daiber *et al* 1966; Nuckolls *et al* 1972). Pressures in excess of 70 Mb have been estimated in various experiments (Ahlborn *et al* 1982; Amiranoff *et al* 1986). There are several methods available for measurement of ablation pressure. These are either based on ablation parameter measurements like mass ablation rate, plasma expansion velocity and momentum of the ablating plasma (Decoste *et al* 1979; Ripin *et al* 1980; Grun *et al* 1981; Daido *et al* 1983; Grun *et al* 1983), target terminal velocity measurements using rear cone calorimetry (Eidmann *et al* 1984; Shirsat *et al* 1986), optical (Grun *et al* 1983; Eidmann *et al* 1984; Dhareshwar *et al* 1985) or X-ray shadowgraphy (Key *et al* 1980; Raven *et al* 1981; Obenschain *et al* 1983) and time-resolved streak record of the visible emission for the rear surface of the impact foil (Obenschain *et al* 1981; Cottet *et al* 1985). In this paper we report another method which is simpler than those in use and provides results with reasonably good accuracy.

2. Experiment

Experiments were performed with a 15 Joule, 5 ns Nd: glass laser. The beam was focussed at the target surface using an aspheric lens of focal length 50 cm. Target and impact foils were parallel to each other with known separation and were placed at the