Figure 18. A description for the electron beam apparatus used for the electron beam exposures at atmospheric pressures of dry nitrogen.

that fraction of the beam backscattered from the substrate. The charge density is defined as

$$Q = (1 + \eta)q$$

where η is the backscattering coefficient of the substrate. All of our experimental results are reported in terms of Q because it is a more precise measure of the number of electrons traversing a thin film. Q is readily converted to adsorbed dose using the methodology outlined previously.[12]

Electron Beam Exposure Apparatus for Exposures at Atmospheric Pressures of Nitrogen. Electron beam exposure of the samples was achieved with a CB 150 Electron Processor (Energy Sciences, Inc., Woburn, MA) which allows exposures of the samples in an atmosphere of nitrogen. A diagram of the apparatus is shown in Figure 18. Basically, the instrument consists of a shielded conveyor that transports the sample under an electron beam. Electrons emanating from a rodlike filament are accelerated and subsequently exit through a Ti/Al alloy window to form a "planar" shaped electron beam perpendicular to the direction in which the samples moves. The electron beam gun operates at accelerating voltages between 150 and 175 kV. The dose delivered to the sample is controlled by adjusting either the beam current or the conveyor speed.

The course of the electron beam induced decomposition was followed by using infrared spectroscopy. Infrared spectra of the solid thin film samples were coated on 1-in.-diameter silicon substrates and recorded with a Perkin Elmer 580 IR spectrometer. The silicon substrates, obtained from Diode Corp., Framington, MA, are polished on both sides and are tapered (8–12 mil) to eliminate interference fringes. A bare silicon substrate was exposed to a 175-kV beam for doses up to 1000 Mrad with no new absorptions appearing.

Dosimetry was performed using the aminophenolmethane dye doped films produced by Far West Technology, Goleta, CA. The thickness of the dosimetric films was 2 mil and the absorbed dose was measured by recording the optical density at 510 nm before and after exposure as reported earlier.[13] A silicon wafer was placed beneath the dosimetric film to obtain the fraction of the absorbed dose from backscattering of the electron beam. The absorbed dose in the sample was obtained by using the equations for stopping power of the sample and dosimeter.[14]

Samples of irradiated material in sufficient quantities for product analysis were prepared by using a tray made from a metal block into which a well, 3 mil deep and of area equal to 160 cm^2, was machined. A viscous solution of material was placed in the tray to flood the well and, subsequently, the sample thickness was brought to 3 mil by pulling a straightedge across the sides of the well and the remaining solvent allowed to dry. After the sample was exposed to the 175-kV electron beam it was collected and stored in capped bottles for analysis.

Registry No. **1**, 5610-94-6; **2**, 114885-79-9; **7**, 879-15-2; **8**, 108-39-4; **9**, 71-43-2; 2-nitro-1-naphthol, 607-24-9; 2-amino-1-naphthol hydrochloride, 41772-23-0; sodium 2-diazo-1-naphthoquinone-5-sulfonate, 2657-00-3; 2-diazo-1-naphthaquinone-5-sulfonyl chloride, 110928-59-1.

(13) Pacansky, J.; Wang, C.; Waltman, R. J. *J. Fluorine Chem.* **1986**, *32*, 286.

(14) Pacansky, J.; Waltman, R. J. *J. Rad. Curing* **1986**, *13*, 24.

Emission Characteristics and Photostability of

N,N'-Bis(2,5-di-*tert*-butylphenyl)-3,4:9,10-perylenebis(dicarboximide)

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The titled dye (**1**) shows very high fluorescence quantum yield values as well as photostability. The dye undergoes molecular aggregation both in the ground state (at a critical concentration of ca. 2×10^{-4} mol dm^{-3}) and in the excited state (giving excimerlike emission at ca. 600 nm). It displays solvatochromism in both emission and UV–visible absorption spectra. The dye does not give laser emission upon pumping ethanolic solutions with a nitrogen laser ($\lambda_{exc} = 337.1$ nm, peak power of 100 kW) but acts as an efficient quencher of 1,4-bis(β-pyridyl-2-vinyl)benzene (P2VB) laser dye. The quenching process obeys a static type mechanism. Equimolar mixtures of dye **1** and P2VB or 2,5-distyrylpyrazine (DSP) laser dyes also give no laser emission. With even higher peak power (200 kW, pulse duration of 800 ps) a laser emission can be obtained from chloroform solutions of dye **1**.

Introduction

The synthesis and spectral identification of several highly fluorescent and very highly stable perylene derivatives have been recently reported.[1] Dyes of such unique characteristics are very attractive in many areas, e.g., dye lasers, and solar energy conversion, and can serve as photosensitizers, photon counters, and

(1) Langhals, H. *Chem. Ber.* **1985**, *118*, 4641.