Dye Lasers: Section Introduction

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Before the advancement of broadband and tunable solid-state lasers, the workhorse tunable laser, available in both cw and pulsed forms, has been the liquid dye laser. The dye laser does not convert electrical power directly into laser radiation but relies on radiation from a fixed wavelength laser or a flashtube for excitation. Though reviled by many for the messiness involved in making up and replacing the dye solution, the fact that the thermally perturbed laser medium is bodily transported out of the lasing region to be replaced by optically uniform, cool medium means that the power-handling capability of the dye laser can be scaled up to several kW of average power. Dye lasers of different types have been available to cover the spectral region from near UV through the visible to the near infrared, and the ability of a single dye-pump laser combination to tune across a spectral region 40–100 nm wide enabled them to gain an early hold as the laser of choice for many physical chemistry laboratories. Today, dye lasers have been practically replaced by various forms of tunable solid-state laser (such as Ti:sapphire) whose fundamental, harmonically and parametrically generated tunable ranges cover most the same spectral region.

The idea of encapsulating the dye medium in a solid host (plastic or porous glass), which is clean to handle and does not require the circulating pump and plumbing associated with liquid dye systems, is attractive from several points of view. True, the inability of the solid-state hosts to dissipate heat does tend to limit both the repetition rate capability and useful lifetime of such devices compared to their liquid dye counterparts. However, there are particular applications in which these features are not overwhelming considerations, and for which the solid-state dye laser provides a simple low-cost answer.