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### **Efficient Low-Pressure Metal-Halide Discharge Plasma Radiation Sources**

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Several efficient low-pressure metal-halide discharge chemistries have been reported in the patent literature since the year 2000.<sup>1</sup> Examples are halides of indium, tin, zinc, and gallium; typical gas mixtures are 200 Pa of a rare-gas and 1 Pa of the metal-halide species. The power density is near 50 mW/cm<sup>3</sup>. The conversion efficiency from electric power to radiation in the positive column exceeds 50 percent in some cases, a value that approaches the efficiency of positive column discharges in mercury and sodium metal vapors. It is not obvious how low-pressure metal-halide plasmas can be so efficient, since the plasma contains not only rare-gas atoms and metal atoms, but also molecules and radicals, where there are many nonradiative loss channels such as attachment, vibration, and dissociation. This talk will focus on work to maximize the fraction of input power that appears as radiation, and at such conditions, identify and understand the important nonradiative power channels.

<sup>1</sup>US6972521, US6731070, US6603267, WO2005117064, US20050242737, WO2005031794, US20060071602.