

Thermal Plasma Technology - from Where Did We Come and Where Are We Going

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要旨

Thermal plasma technology is more than 200 years old. The initial advances in thermal plasma technology were driven by specific applications, once the required power sources became available, and they were closely associated with visionary personalities. The development of the fundamental scientific knowledge in areas like thermodynamics, heat transfer, electrodynamics, quantum theory and atomic physics followed these initial uses of plasmas, but not until the 1920ies were efforts pursued to establish a science base for describing plasmas. The most prominent applications at that time were metallurgical arc furnaces, lighting, welding and coating. Two important applications had a strong impact on the further development of thermal plasma technology and its science base, the quest for achieving controlled thermonuclear fusion and the space program in the 1950ies and 1960ies. The increasing demands for materials with better functional properties led to new developments of plasma processes, new types of plasma sources suitable for specific materials processing applications, with a parallel development of the science base. The new developments now require background knowledge in several different areas, such as materials science, fluid dynamics, heat transfer, and plasma physics, because the advances in the applications have been very specialized. Multi-disciplinary approaches have become the norm. There remain some fundamental science problems to be solved, such as various plasma instabilities and plasma – solid interactions under extreme conditions of very high heat fluxes and material evaporation. Solutions to these problems can further expand uses of plasma technology.



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