PhD in Electrical, Electronics and Communications Engineering

Research Title: Study and design of hollow core wave guide for LASER beam propagation

Funded by	CEMAS ELETTRA SRL

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Context of the research activity	The address of the present project is the knowledge of the laser guide design for high volume and low price or mass production. The study of laser application in plastic welding is already in development and in particular, the simultaneous laser welding is up to now at the state of the art related to the joining of composite plastics materials. This topic is well integrated with the H2020 agenda, where the European Community incentives to develop high-tech processes and products to support the economy and the development of the European countries in a more robust way compared to out-fashioned policies characterised by low technical level of production and subsequent struggle towards reduction in production costs. According to the new market research report "*Laser Technology Market by Type (Solid, Liquid, Gas), Application (Optical Communication, Laser Processing), and Vertical and Geography - Analysis & Forecast to 2022*"[1], the laser technology market is expected to reach USD 14.67 Billion by 2022, at a CAGR of 5.33% between 2016 and 2022. The ability of this technology to offer significantly high precision, flexibility, and productivity in the material processing application than any other traditional approach is leading to growing preference for laser technology-based material processing. This is one of the major drivers for the laser technology market. Moreover, the widening scope of laser technology in various verticals including medical, aerospace & defense, research, semiconductor & electronics, and telecommunications among others is further driving the growth of the above said market. This growth can be attributed to use of lasers in cutting, drilling, welding, and engraving for

	automobiles, mobile and other electronic devices, disk lasers, laser doping of solar cells and many other application areas. The solid state lasers market is expected to lead the above said market during the forecast period. The increasing use of solid lasers especially in fiber lasers and semiconductor lasers is accelerating the growth of this market. Solid state laser are mainly applied in this upcoming machine design.[2] Furthermore, high revenues and robust IPR protection for the obtained results should be the goal the present research activity. The present project is related to the collaboration between CEMAS and Politecnico of Torino, this previous research was preparatory for the incoming projects submitted in 2016 in the framework of the call *"Bando regionale "Piattaforma Fabbrica Intelligente*" (Piedmont Region) and *"POR-FESR 2014/2020 Bando IR2 - Industrializzazione dei Risultati della Ricerca"* (Piedmont Region). [1] *http://www.researchandmarkets.com/research/sq26g7/laser_processing* [2] *http://www.marketsandmarkets.com/Market-Reports/laser-technology-market-795.html*

Objectives	The research activity aims at the study of laser beam propagation in glass optical fibre and particular attention has to be paid for the laser beam propagation into metallic hollow core wave guide. Since these are the main topics, the aims of this PhD are: 1) Design of beam shaper for different laser sources; 2) Study and characterization of glass optical fibres, bundles and metallic wave guides; 3) Design of glass fibres/bundles and metallic wave guides;

Skills and competencies for the development of the activity	The candidate should have strong background in ray tracing design tool and micro technology processes by laser. He/she will perform the optical design for laser photo-thermal treatment and welding, then the following competencies are required: - Optical and ray tracing competences. - Knowledge of welding processes for polymers and composite materials. - Strong competences in mechanical design at microscale and in particular in metallic wave guides. - Computer Assisted Design such as Solidworks or similar and tool for ray tracing.