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SCIENTIFIC KEYNOTE: Sustainability in Forging

Forging a sustainable future: the role of research and innovation in shaping new paradigms

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Prof. Ghiotti research interests focus on manufacturing processes and systems, in particular in the areas of material forming, machines and characterization of thermal-related aspects for the control of micro-scale phenomena in the field of metals manufacturing. The results of his scientific work contributed to innovative approaches for the testing and characterization of metals in advanced manufacturing processes. In his research he integrated analytical methods, numerical approaches based on finite element analysis and optimization strategies, and innovative sensing techniques applied to the process monitoring and control. Current research focuses on adaptive and self-optimizing processes with the design of innovative measurement sensors and metalforming machines.



Andrea Ghiotti

Prof. Ghiotti has strong international connections in the field of manufacturing and is active within the scientific community. He is fellow member of The International Academy for Production Engineering (CIRP) since 2021, full member of the International Cold Forging Group (ICFG) since 2013, where he was member of the Advisory Board and chairman of the Process Simulation subgroup, member of the Italian Association for Manufacturing Technology (AITEM).

Abstract

For decades, forging has stood as a cornerstone of manufacturing technology in numerous high-tech sectors such as transportation, infrastructure, defense, and even prosthetics. Its unparalleled ability to shape complex geometries, combined with superior mechanical properties and durability, remains unparalleled by many other processes, making it an invaluable k-factor for the success of many applications. However, the advent of electrification, innovative materials, and the drive towards more customized and environmentally friendly products pose new challenges that demand comprehensive and systemic responses. This evolving context requires us to reconsider traditional practices and explore sustainable methods that minimize environmental impact. The emergence of trends like product



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customization, market fragmentation, and a heightened focus on ecological sustainability compels the forging industry to adapt, demanding agility but also an unwavering commitment to innovation and environmental stewardship. It follows that, the forging industry appears at a crucial point: waste reduction, energy saving, lowering emissions, do not represent abstract trends, but the pillars of the next developments of manufacturing industry. It's about ensuring the industry can continue to thrive and produce the high-quality parts needed by so many sectors, but in a way that's better for our planet.

This presentation dives into why this change is so necessary and proposed some development perspectives concerning the role of research to sustain innovation and the definition of new paradigms for metalworking sector. There are exciting developments in materials science, energy efficiency, and waste reduction that could benefit of forging and evolve traditional process chains towards to answer the new needs. Stories of success will be shared, where new ideas have already made forging more “friendly” and sustainable.