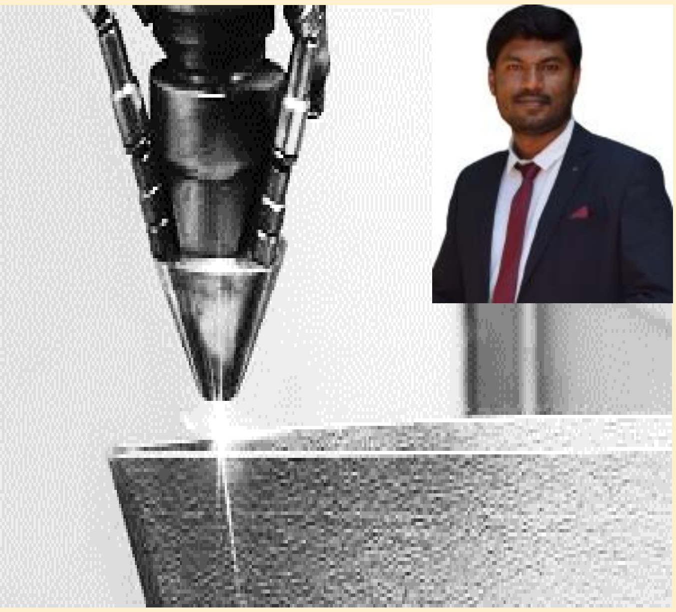
ATRIA INSTITUTE OF TECHNOLOGY

Department of Mechanical Engineering

ADDITIVE MANUFACTURING LABORATORY



Srinivasa Chari V is currently working as Assistant Professor in Mechanical Engineering at Atria Institute of Technology, Bangalore.

He is also professor in-charge for Centre of Excellence in Additive Manufacturing at the institute.

He is pursuing Ph. D. in Metal Additive Manufacturing from Visvesvaraya Technological University (VTU), Karnataka, India, and Master of Technology in CAM/CAM from JNTUA, India. He served various nationalorganizations as Assistant Research Scientist.

He is specialized in metal additive manufacturing, welding engineering, advanced and materials processing techniques.

He has published book chapter, research papers in SC-indexed journals of international repute. He is also a recognized reviewer for many international journals in his field of specialization

Metal Additive Manufacturing (MAM) is one among the seven important categories of AM processes documented under Direct Energy Deposition (DED) category by American Society for Testing of Materials (ASTM).

The unique capability of producing large components in local/open atmosphere using an electric arcas heat source and metal wires as feed stock available in wide range is making this process more economicaland popular for extensive applications. We are working on imperative processing parameters corresponding to deposition rates, metallurgical aspects, and in-situ properties of the deposited components.

The phenomenonbehind generation of defects, challenges, and significance of post processing deployed in WAAM areinvestigated at CoE-AM, Atria Institute of Technology.

Wire Arc Additive Manufacturing (WAAM) is a part of CoE-AM. This facility consists of a digitally controlled plasma/TIG welding power supply, a 6 axis CNC motion controller and precise wire feeding arrangement. Fig. 1depicts the schematic of the wire arc additive manufacturing facility developed to cater large scale material deposition in layer by layer fashion. It is developed by integrating a plasma/TIG welding torch and an indigenously developed wire feeding system with an X-Y worktable on which the substrate can be mounted. The spool of variety of metal wires can be loaded on the wire feeding system which can feed the wire at rate of 200 to 2000 mm/min. The nozzle of plasma welding system is suitably modified for feeding the wire to the melt-pool. Argon gas is used for both plasma generation and shielding. A constricted arc will be established between the tungsten electrode positioned within the body of the torch and the copper nozzle through charging of plasma gas flowing between them. This arc is transferred to the workpiece through an additional circuit provided between plasma nozzle and the substrate. The intense heat produced through plasma causes melting and fusion of filler wire along with little melting of the substrate (wetting). The melt pool is throughout protected by providing an envelope of the shielding gas throughout the process. This system has maximum plasma power capacity of 2500 W. The worktable is having travel length of 250 mm in X-direction, 200 mm in the Y-direction and a maximum travel speed of 100 mm/min.

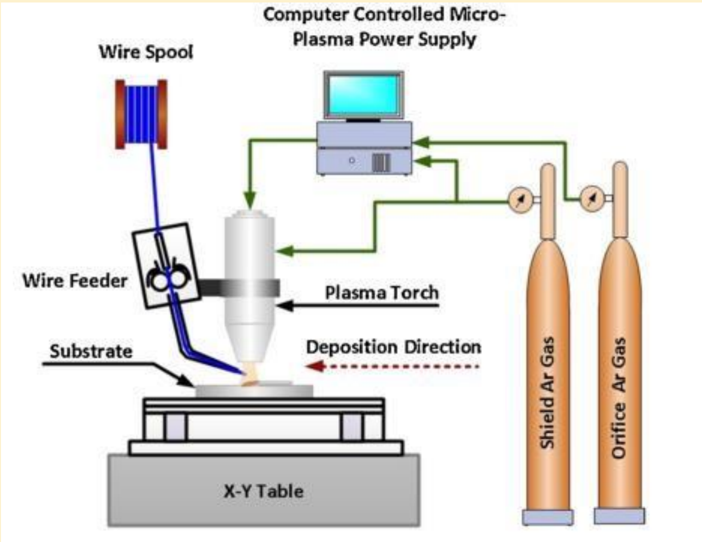


Fig1: Schematic of the experimental Wire Arc Additive Manufacturing (WAAM)

What can be processed: Titanium alloys, Inconel, Tantalum, Niobium, Stainless Steels, Aluminum Alloys, Steels, Tool steels, Zircalloy, Copper Nickel Alloy and many more.
A typical tool steel deposition is presented below in Fig.2

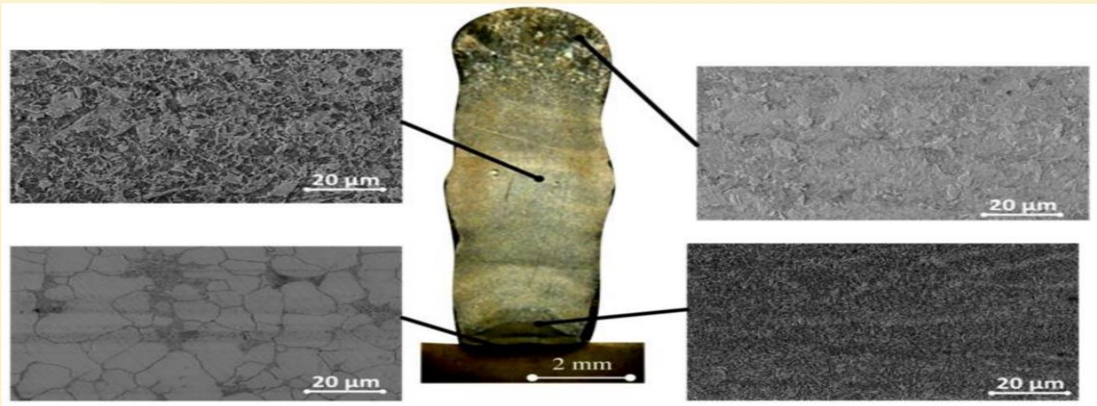


Fig. 2: Cross-section of typical multi-layer deposition and SEM images at various locations along its height(Jhavar et al. 2014)

OUTCOMES

- Students will have exposure to product design, 3D printing software interface and 3D printing.
- Hands on experience of multiple 3D printable materials and mechanism involved.
- Display the function of latest Metal-3D printer at ATRIA which is one on its kind in India.

OBJECTIVES

3D printing industry has proven to have significant implications for such industries as automotive, machinery, aviation and more, and the applications will continue to grow as these industries show the technology's efficiency and effectiveness in production. To inculcate 3D printing technology into the hands of students and introduce them to some of the challenges facing the community. They will learn empathy, teamwork, and problem solving as you set them loose on a real-world problems. students with the basic know how of the broad domain of mechanical engineering and also to expose the broad spectrum of mechatronics in conjunction with mechanical engineering in terms of knowledge, career opportunities and industry perspectives. (picture are attached below)

The following are the listed objectives of CoE-AM

1. Develop infrastructure in terms of labs and facilities.
2. To increase research and promote innovation.
3. Impart extensive training for internal and external customers.
4. To provide industrial solutions and built collaborations.
5. To develop presentation material showcasing AIT leadership.

6. Organizing awareness seminars and conferences
7. Forming international alliances with organization involved in manufacturing/ consultancy/in the relevant fields.
8. To apply for research funding from external agencies.
9. To promote inter-disciplinary research at AIT.
10. To work for better graduation outcome.
11. To increase AIT's outreach.
12. To change the perception for AIT.

Our Active Research Collaborations

- Prof. Satyam Suwas, Materials Engineering, IISc Bangalore, India.
- Prof. Anand Subramanian, IIT-Jammu-India
- Dr. N. Balashanmugam, CMTI, Bangalore, India
- Mr. Nagesh BK, GTRE, Bangalore, India

Prof Satyam Suwas, IISc, Bangalore: Laboratory for texture and related studies, led by Prof. Satyam Suwas, is dedicated to pursue research in the field of crystallographic texture. The domain of the laboratory extends from microstructural engineering to their influence of material properties. We, at Atria Institute of Technology can process the samples on plasma additive manufacturing and are capable to evaluate the same micro-structural led mechanical properties. However, association with Prof. Suwas can help us in the study of conventional thermo-mechanical processing with a modern approach.

While our major strength lies in the development of novel processes and undertaking experimental studies on these processes with a variety of materials. Our association with IISc helps us to explore the deeper aspects of material behaviour at texture level. We carry out crystal plasticity-based simulations aiming at prediction of crystallographic textures along with mechanical properties. The current research students at IISc are engaged in exploring processing-texture-properties relationship in titanium alloys, magnesium alloys, refractory metals and alloys, shape memory alloys and steel. We employ various characterization tools like XRD, SEM-EBSD, TEM, mechanical testing and computational tools for our research to gain depth in process development. We have successfully completed several initial results on developing materials where we have achieved remarkable improvement in mechanical properties of samples prepared using plasma additive manufacturing.

Hyperlink :

https://materials.iisc.ac.in/~satyamsuwas/collabration.html

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