Latest Advancements in the Surface Performance of Microwave Cladding and the Future Scope – A Critical Review

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Abstract. Microwave cladding is a revolutionary, cost-effective technique of enhancing the surface characteristics of metallic components. Microwaves are becoming increasingly popular because they aid in the uniform heating of materials on a molecular scale. Partially diluting of the substrate and subsequent creation of metallurgical bonding between the clad material and the substrate are the most common methods for obtaining the coating. Microwave cladding may be used on a diverse set of materials with less cost and time of production. Another feature of microwaves is that they produce no emissions, which is crucial for promoting green manufacturing technologies. This article highlights the existing state of research on the microwave cladding of different substrates by suitable clad materials. The article further discusses the various surface modification parameters i.e. microstructure, microhardness, and tribological properties used by past researchers. It also reports the past researchers' findings and points out the future research scope in this subject.
Keywords: Microwave, Cladding, Surface Modification, Substrate & Cladding powder.

INTRODUCTION

Low wear and corrosion resistance of the metal causes surface integrity to deteriorating and base materials to be damaged. While in operation, certain components of equipment used in mining, mineral processing, manufacturing, agriculture, and a variety of other sectors are subjected to significant wear and corrosion. There are two approaches to avoid damage to base materials caused by such a problem. The first method is to make the components out of a material that is resistant to wear and corrosion, and the second method is to modify the functional surfaces of the components. Surface modification is more cost-effective than the prior technique in practice [1]. Surface modification can be accomplished through a variety of methods. Some of them entail methods such as Tungsten Inert Gas Cladding (TIGC), Laser cladding (LC), and Plasma Transferred Arc (PTA) cladding, etc. These are the most suitable ways to enhance the major mechanical and tribological properties of materials. These methods have certain advantages, but they also have some limitations [2]. They carry significant initial and ongoing costs, as well as the creation of a hazardous radiation environment. To overcome the constraints of conventional technologies, it is necessary to develop a cost-effective alternative approach that makes use of some sort of energy source [5].

Microwaves are electromagnetic waves that have wavelengths ranging from one millimetre to one metre with remarkable uniform heating properties [1]. This remarkable heating property of microwaves has prompted academics to look for ways to use this type of energy in materials processing and industrial applications. Microwaves have been utilized as an efficient energy source for heating various metals in recent decades. Microwave cladding is a newly discovered approach for overcoming the limits of conventional cladding technologies by using microwave radiation as a heating source. It's a low-cost method with excellent metallurgical bonding with improved mechanical and tribological features. Microwaves also have the advantage of being emission-free. As a result, the advancement of microwave-based processing technology is critical since it reduces reliance on fossil fuels and other high-energy-based heating systems. Microwave cladding presents itself as a viable alternative to traditional cladding methods as there is a rising awareness of reduced emissions and initiatives in the industry to embrace greener technologies [8].

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