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MICROWAVE WELDING USING STAINLESS STEEL GRADES – A SHORT SURVEY

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Abstract: This paper deals with Microwave welding using stainless steel grades. The field of microwave joining had taken a great leap in the past decade, Due to its special and exceptional characteristics like selective heating, volumetric heating and inverted heating profile its has been introduce in the field of the microwave joining of materials ,previously which was limited only to the processing of food. It also has an edge over conventional methods due to these characteristics. Microwave energy is generally new area of topic in material welding or material joining even though it has been introduced already in many industries like medical, food processing, drying. This process with the help of microwave radiations deals with joining of similar and dissimilar materials. These joints were characterized using various techniques.

Keywords: Microwave welding, XRD, EDS, SEM.

I. INTRODUCTION

Microwave material processing has emerged as one of the promising as well as area of growing interest of sustainable process in manufacturing sectors. The distinguished as well as unmatchable characteristics of microwave radiations like volumetric heating, less power consumption, eco-friendly with environment (that is, it does not create any harm to the environment), high quality products(that is, the number of defects will be too low),it can weld or join a specific area of the work etc. are attracting quite large numbers of researchers in this field. Material joining or Material welding is one of the important manufacturing processes which are used widely in industries for production of even complex or intricate parts. Material heating process during joining/welding is important part of process, which is still uncontrollable. This paper contains the fundamental of heating of material through microwave radiation and its application in different fields of engineering and technologies

II. HISTORY OF SURVEY

Various literature surveys about microwave welding have been made from recent research articles and some of the observations are listed in this section.

YingnaZhao, Xiongfeng Zeng, Guiquin Hou, Wenli Zhang investigated the joining of Al203 ceramics using Nano metric Si powder as an inter layer material. His studies investigated that this process account for high temperature, high wears and corrosion resistant material applications.

Roberto Rosa et al. developed a novel technique of joining of engineering ceramic silicon carbide (SiC) by microwave assisted combustion synthesis. His studies investigated that this process increased the strength of welded joints. In order to get the heat absorbed by the materials during the process and also to calculate temperature of the weld joints during various intervals of time, the author conducted numerical simulation which was quite a difficult task during the ongoing experiment.

Arpita Roychoudhry, Vinay Sharma Analyze the microwave welding of thermoplastic with the contemporary method of welding using prioritization matrix. Reduction in hazardous emissions had been observed. Microwave welding provides an environmental friendly, cheap and time saving method of joining thermoplastics.

Sudhir Kumar, Parteek Gupta Investigated the microwave irradiations fabricated joint of stainless steel using 99% pure Ni based powder (EWAC) mixed with resin as an interface between substrate. The microstructure revealed that there is very less porosity and no cracks.

Ajay Kumar, Prateek Gupta, Sudhir Kumar Studied the joint produced between mild steel and stainless steel by tungsten carbide bearing alloy through microwave welding. The experiment was carried out successfully and found that it improved the quality of the joint.

Shashi Parkash Dwivedi, Satpal Sharma conducted the experiment on the effect tensile strength process parameters of1018 mild steel joint , which was formed by microwave irradiations.

Ravinder I. Badiger, S. Narendrnath, M.S. Srinath conducted experiment which showed a new way of joining Inconel-625. It was done with the assistance of Ni based alloy as a sandwich layer between the substrates. While performing this microwave multimode applicator at certain frequency was utilized. The joint characterization has been done through XRD, SEM and Micro hardness survey.

Roberta Rosa, Elena Colombini, paolo Verones, Giorgio Poli, Cristina Leonelli in order to join dissimilar metals quickly, by using specially designed powder mixture as an interface material, ignition of combustion synthesis (CS) reactions can be done using microwave energy .In order to validate experimental data , whole process Numerical simulation was done.

M. Shrinath, Apurbba Kumar Sharma, Pardeep Kumar investigated that for thermo-conductive materials like copper the process of microwave joining or microwave welding has been found technically quite challenging. In this a subsector material was used in the slurry of charcoal for the purpose of assisting during the process of heating. The joint characterization was carried out through micro hardness survey, micro structure study, porosity measurement and tensile strength testing.

Osepchuk John M presented brief history of micro wave energy .It was done or explained on the basics of micro energy .During his studies he also discussed about microwave power applications.

Clark De. Et al., reported that the successfully sintering could be done for the pure metallic powders like Cu, Al, Ni, Mo, Co,Ti, W, WC, Sin, etc.It was carried out or done through microwave technique . It was in material processing that they put their full effort while they used microwave energy.

Rodiger k. Et al. explained that a new area with utmost growing interest had been forming in the microwave sintering. Also it possessed high electrical conductivity. When compared to conventional heating processes, microwave heating provides for volumetric heating as well as for instantaneous heating. During last decade, for the sintering of various particulate metals microwave has been used.

Roy R. Et al., reported that in a microwave field powder metal compact which was porous in character could be heated as well as sintered. At present, there are quite few reports that regarded the direct interaction of microwave details with powder metal compacts.

Also few researchers investigated that microwaves were absorbed at room temperature by all powder metals, also microwaves were reflected only by bulk metals and also another important point that he reported was that it allowed only surface penetration.

Gupta M. And Wrong WLE. Reported that rapid sintering of aluminum magnesium and lead free solder was assisted by two-directional microwave .It was reported in his study that microwave sintered density and the samples which were sintered were the same. It was also reported that by him that overall metallic material performance increased to a large extent.

Aggrawal Dk., reported that using a braze powder it was possible joining or welding of regular steel and cast iron in a microwave field. It was done practically over a period of 2 -3 min. But his studies also reported that joining of bulk metallic materials was never possible using microwave energy.

III. METHODOLOGY USED

The joining experiments were conducted in microwave applicator working at frequency of 2.45GHz. The process was carried out at a power of 900 watts. The optimization of joining time was carried out before conducting final experiments and it was found that 7 minutes were sufficient for joining. The slurry of Nickel based powder EWAC was introduced between faying surface and joint was protected from susceptor (charcoal) by using thin sheet of graphite.

CONCLUSION

For the past two years , microwave welding has emerged as one of the most important type of welding due to its special characteristics. After searching various sources , even though it is incomplete , but still hopefully a useful reference bank on which a study on microwave welding using stainless steel is conducted in this paper. We intend to update this literature review in both completeness of coverage and correctness , in future , to serve better the studies regarding this particular topic and hence provisions for microwave welding related information with authors would be much welcome and highly appreciated .

REFERENCE

1. Sudhir Kumar, Parteek Gupta “Investigation of stainless steel joint fabricated through microwave energy” journal of material and manufacturing process, vol 29 (2014), pp. 910-915

2. Arpita Roychoudhry, Vinay Sharma; Microwave welding “A comparative analysis with contemporary method of welding thermoplastics based on prioritization matrix” international journal of scientific and engineering research , vol 5 issue 10 (2014), pp. 1199-1206

3. Ajay Kumar, Prateek Gupta, Sudhir Kumar “Study of joint formed by tungsten carbide bearing alloy through microwave welding” material and manufacturing processes, vol 28 (2013) pp. 601-604

4. YingnaZhao, Xiongfeng Zeng, Guiquin Hou, Wenli Zhang “Interface reaction of joining aluminum oxide ceramic by microwave method”, journal of advance material research vol 753-755 (2013), pp. 388-391.

5. Roberta Rosa, Elena Colombini, Paolo Verones, Giorgio Poli, Cristina Leonelli, Monica Ferraris, Milena Salvo, Shahoua Han “Microwave assisted combustion synthesis in system Ti-Si-C for joining of SiC: Experimental and numerical result”, journal of European ceramics society 33(2013), pp. 1707-1719

6. Osepchuk John M, A history of microwave heating applications. IEEE Trans Microwave Theory Technol,; 32(9):1200–24.

7. Osepchuk John M. Microwave Power applications. IEEE Trans Microwave Theory Technol; 50(3):975–85.

8. [Clark DE, Sutton WH, Lewis D. Microwave processing of materials. Annu Rev Mater Sci 1996; 26:299–301.

