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Research Article

ANALYSIS OF DISSIMILAR JOINING OF METALS BY POWDER METALLURGY ROUTE

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ABSTRACT

Dissimilar metal joints have a wide range of applications in electronic connectors, due to its physical and mechanical properties. In the present work powder brazing is chosen as a tool for joining of Cu-SS, Cu-Fe, and Cu-Ni.

Powder brazing of dissimilar metals has advantages over conventional joining techniques which does not involve melting of the base metal and thus avoids the problems associated with, variation in thermo-physical properties and leads to formation of high amount of undesirable compounds (high intermetallic layer at the joint interface) as a result high joint strength cannot be achieved, an able solutions to produce this type of joints has been developed.

In the present work three different types of powder are chosen for brazing, Copper (Cu)-Stainless Steel (SS), Copper-Iron (Fe), Copper-Nickel (Ni) powders. Cu weight (2 gram), stainless steel powder (2 gram), iron powder (2 gram), and Nickel powder (2 gram), then the specimen were compacted with varying loads (4, 5, and 6 tonne), the compacts were in the shape of cylinders. The compacts were sintered at 900 °c in argon atmosphere with a heating rate of (10 k/min), the specimens were cross sectioned using abrasive cutting machine, mounted and polished for macroscopic and microscopic observation. The mounted specimens were polished with emery paper of 1/0, 2/0, 3/0, and 4/0 and were subjected to chemical etching using nital solution. To study macro and microstructures of the specimen optical and scanning electron microscope was used. Form the macrostructures it was observed that there is no presence of cracks in all the joints. It was observed that with the increases in compaction load there is a better bonding between the joints. Microstructures did not show any presence of Intermetallics. Form the hardness data it was confirmed that there is a presence of Intermetallics due to marginal variation in the hardness at the interface in all the cases. From the compression test it was observed that with the Cu-Ni has shown improved strength compared to Cu-SS and Cu-Fe. At higher compaction loads the specimens has shown higher strength in the all the cases (Cu-SS Cu-Fe, Cu-Ni) may be due to better bonding.

INTRODUCTION

The fundamental goal of the present work is to join the Copper to Stainless steel, Copper to Nickel and Copper to Iron through powder metallurgy course. The broad utilization of these materials in industry needs to choose this mix of metal powders for unique metal joints. Powder metallurgical parts have imperative applications in aviation and force area, the present joints Cu-Steel discovers applications in auto commercial ventures as shrubberies, rollers in roller skates and a washer for hosing, electronic connectors and link joining,

Joints in the middle of ferrous and non-ferrous metals are of concern to industry in light of the fact that they join the quality and sturdiness of steel with the exceptional properties like erosion resistance, malleability and warm conductivity of copper.

The joining of divergent materials gives generally distinctive physical attributes, for example, liquefying temperature, vaporization temperature, coefficient of warm development, warm diffusivity, compound contradictorily i.e., development of moderate stages frequently exceptionally undesirable, bringing about an extreme disintegration of properties. With respect to this a few arrangements are mechanical joining, conventional securing (jolts, bolts and so forth.), mechanical interlocking, and strong state joining. Joining of divergent materials is turning out to be progressively imperative as specialists take a stab at decreased weight and enhanced execution for building structures.

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Joining of divergent metals through routine (welding) procedure needs to address a few issues, for example, Copper behaviours heat vitality up to 10 times speedier than steels, which has a tendency to scatter warm rapidly far from the weld prompting troubles in the dissolving temperature of copper. Other than that there is a limited solubility of Cu in Fe. One more major problem in welding is hot cracking in the heat affected zone of steel as a result of copper penetration in to grain boundaries of steel.

LITERATURE REVIEW

M .S. Srinath [1] has analysed on microstructural and mechanical properties of microwave took care of diverse joints. Microwave joining of stainless steel (MS) in mass structure has been viably done using a multimode utensil at 2.54 GHz and 900w.principles of crossbreed warming were used using a susceptor medium so as to begin coupling of microwave with the metals. Ni based metallic powder sand witch layer between the mass pieces. Tests were displayed to microwave radiation in climatic conditions. They portrayed by FESEM,X-Ray diffract or, Micro hardness analyser, complete testing machine. Microstructure shows that faying surfaces were all that much merged and got fortified on either side of the base material. This prompts advancement of cementite and metallic carbides were affirm. Vickers Micro hardness of focus of the joint is 133hv,0.58% is porosity, great unbending nature of the joint is 346.6 MPa, rate of extending is 13.58%. Fractography reveals that the joint failed in light of both shearing of the delicate carbides and oxides furthermore due to plastic stream of the malleable structure under flexible stacking.

C. Shanjeevi [2] inspected the evaluation of mechanical and metallurgical properties of dissimilar materials by contact welding. The materials are austenitic stainless steel (304L) and copper were explored by flexible test and hardness test. Metallurgical properties of OP,SEM and atomic force microscopy was used to look at the microstructure of the welded joint ,in like manner reviewed by EDX line in order to fathom the stages formed in the midst of welding. Bendable test, the quality is determined and the hardness test estimations are investigated in base metal and warmth impacted zone.

The braced materials were conveyed by fluctuating the grinding weight, sensation weight and rotational speed through taguchis orthogonal display. The results was viewed the most significant flexible test procured in crushing welded joint was 2.52% higher than watchman material of copper. The effects of metallurgical depiction are discussed in light of the microstructural studies.

RESULTS AND DISCUSSIONS

Compression Test

Figure1 demonstrates the hardness graphs of Cu-Ni sample a) 4 ton b) 5 ton c) 6 ton form the diagram it can be watched that with the expanding the compaction load there is an expanding in the strength of the joint this could be because of better diffusion of Cu in Ni and all the more over at higher compaction load there is better bonding happens.

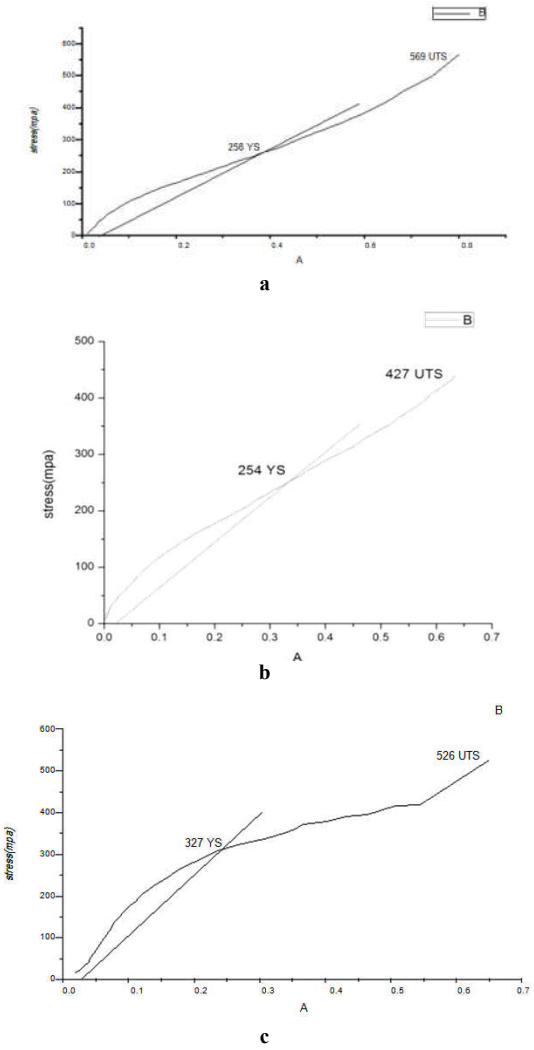

Fig 1 Stress strain plot obtained from compression test of Cu-Ni sample a) 4 ton b) 5 ton c) 6 ton

Hardness Test

Figure 2 demonstrates the hardness graphs of Cu-Ni sample a) 4 ton b) 5 ton form the diagram it can be watched that copper has low hardness contrast with nickel. Form hardness data it was affirmed that there could be a vicinity of Intermetallics because of marginal variation in the hardness at the interface in all the cases.

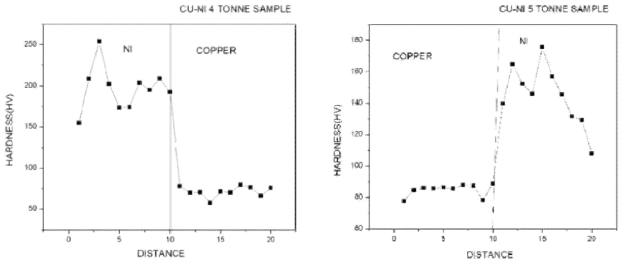

Fig 2 Hardness graphs of Cu-Ni sample a) 4 ton b) 5 ton

Table 1 Consolidated compression data of all the joints

TABLE	CU-FE 5 TONNE	CU-FE 4 TONNE	CU-FE6 TONNE	CU-NI 4 TONNE	CU-NI 5 TONNE	CU-NI 6 TONNE
UTS	430	183.5	398	569	427	526
YS	230.30	172.2	261	258	254	327

CONCLUSIONS

- Porosity is not visible from optical micrographs.
- Good bonding is watched from the optical micrographs
- Intermetallics are not noticeable from the optical micrographs furthermore from the SEM investigation.
- Cu-Ni has indicated higher mechanical properties.
- There is no break arrangement in the intermetallic region.
- Cu-SS has indicated enhanced mechanical properties of the joints.
- Form the hardness information it vicinity of Intermetallics can't be administered information because of minor variety in the hardness at the interface in all the cases. To affirm this future study is needed.

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