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DESIGN OF COMPACTION DEVICE FOR TI64 ALLOY POWDER PARTICLES

Mr. S. Rajaganapathy, Mr. M. Periyasamy, Mr. P. K. Sriraman, Mr. S. Vinoth Kumar

Department of Mechanical Engineering, K.S.R. College of Engineering Tiruchengode, India

ABSTRACT

Conventional powder forming of metals. Ceramics and composite uses room temperature pressing approaches such as uniaxial pressing, isotropic pressing cold isostatic pressing (CIP) or elevated temperature hot isostatic pressing (HIP) methods. In this paper description of a unique dynamic pressing approach for powder materials will be presented where very high pulse pressures are applied for short duration on powders. Such a dynamic pressing offers the ability to form uniformly high density net shape parts with fine microstructures. This method can be applied to wide range of materials such as metals, ceramics, composites. A broad range of powder particle size distribution ,from coarse micron size to fine nano size powders, can be used in this process. Dynamic Magnetic Compaction process discussed in this paper.

Keywords: Composite, Dynamic Magnetic Compaction, CIP,HIP

I. INTRODUCTION

Rapid quenching following solution treatment is important in order to maximize the formation of alpha martensite phase which in turn maximizes the aging responses. Other heat treatment used on include stress relieving for formed or welded parts and beta annealing which is used for like other titanium alloy. Vacuum annealing can also be used to remove excess hydrogen pick up a process known as vacuum degassing[1].This method of heating is of great interest to materials and manufacturing industries as it is fast, precise and controllable. Heat treatment is a group of manufacturing techniques used to alter the hardness and toughness of a material. Heat treatment includes annealing, case hardening, induction hardening tempering quenching[2].Accordingly the theory of induction heating was studied so that motors and transformers could be built for maximum efficiency by minimizing heat losses. The application of induction heating as applied to induction heat treating [3].Three main induction coils styles were cylindrical coils, hair-pin coils, rod-type coils. The first two styles might be strongly improved by application of magnetic cores[4].Die compaction of powder process which involves filling with a die powder compression of the powder using rigid punches to form a dense compact and ejection from a die. The choice of powder composition and selection of parameters determine the microstructure and final properties of the compacts [5].

II. PROBLEM IDENTIFICATION

Nano crystalline materials have been synthesized and analyzed by using various techniques. Researchers didn't compact and analyze the mechanical properties such as hardness of Ti64 powder. In this we are focusing to synthesis and consolidate nano crystalline powders. In hot compaction method using induction heating method. Clean and fast being supplied to the heated workpiece meets the considerably increased the requirements with regard to environmental protection. Induction heating provides a heat source which is very easily controllable and create heat up process. Heating equipment with a level of automation which allows to be integrated in a production line such as machine tools.

III. AIM OF THE WORK

The first and foremost aim of the work is to formulate a small sized device to compact powdered materials using hot compaction technique. In this research we found the induction heating method is the best method to heat the materials without much damage.

IV. DYNAMIC MAGNETIC COMPACTION PROCESS

The induce current interact with the applied magnetic field to produce an inwardly acting magnetic force that compacting the powder. The energy transfer to the object to be heated by means of electromagnetic induction. Any electrically conductive material placed in a variable magnetic field of induced electric current which eventually lead to joule heating. The powder filling can be carried out in special environments and also compacted at elevated temperatures with suitable system modifications.

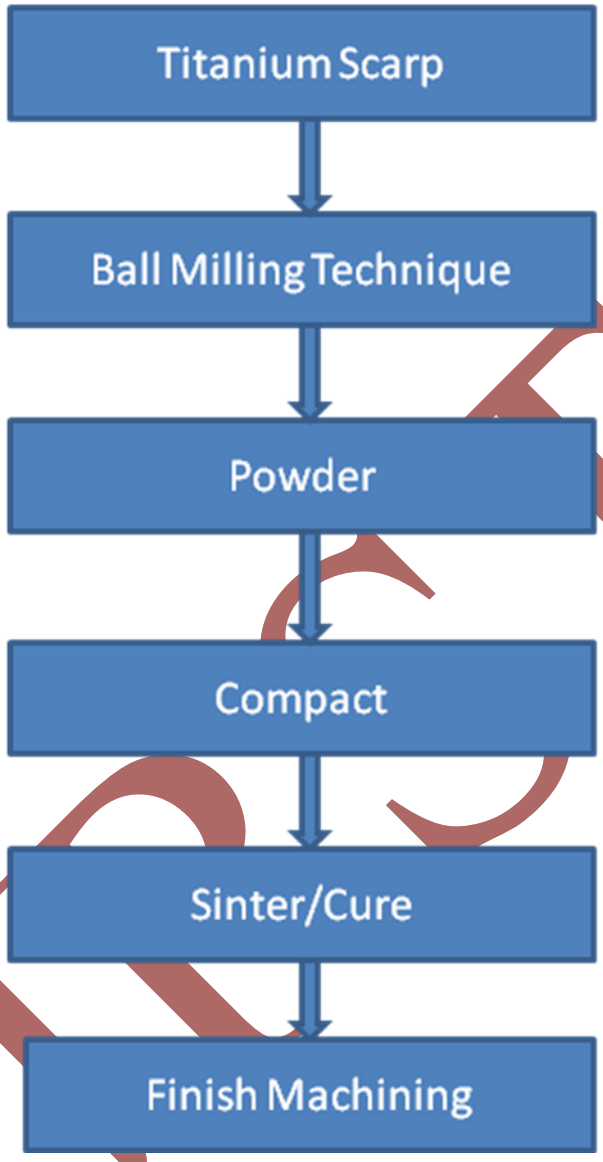

Fig 1.Dynamic Magnetic Compaction Process

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V. DESIGN OF COMPACTION DEVICE

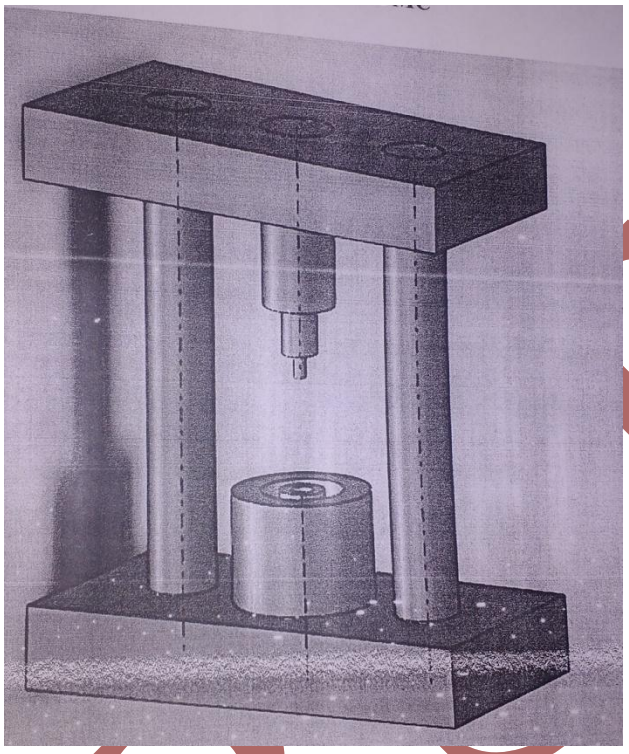

Fig 2.Dynamic compaction Device

VI. POWDER MAKING PROCESS

Titanium is taken from the machined scarf. Then the scarf is mixed with the acetone solution. Acetone solution is used to purify the titanium. An ultrasonic cleaner is a cleaning device that uses ultrasound and an appropriate cleaning solvent to clean delicate items. Ball mills rotate around a horizontal axis partially filled with the material to be ground plus the grinding medium. Different materials are used ceramic balls, flint balls and stainless steel balls.

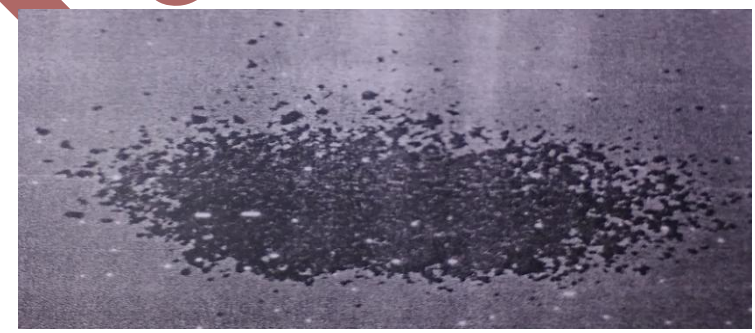

Fig 3.After 5 hours

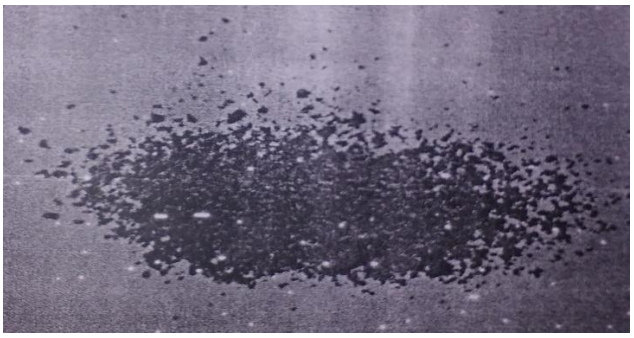

Fig 4.After 15 hours

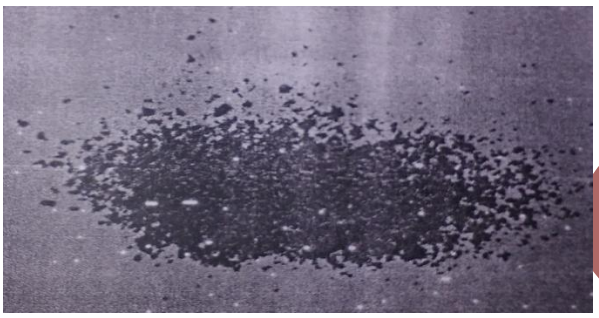

Fig 5.After 30 hours

VII. HEAT TREATMENT

Heat treatment is a group of manufacturing techniques used to alter the hardnend and toughness of the material. Heat treatment includes is not limited to annealing, case hardening, induction hardening, tempering and quenching. A metal has been hardened can be too brittle for a final product unless it is further conditioned with heat. Usually the metal is held at a temperature for a set amount of time and then cooled slowly over a time period. The heating can be cycled and cooling of each cycle forms crystals within the metal.

VIII. CONCLUSION

The DMC process holds potential for expanding P/M markets into full density and high performance products. The process feasibility is demonstrated for various powders of ferrous ,non-ferrous, ceramic and composites. The development of specific prototypes parts with steel powder for automotive industry, electric motor parts have been accomplished. Other product applications with different powder materials are being investigated.

IX. REFERENCES

1.E.J.Davis ,"Induction heating Hand book", McGraw Hill,1979.

2.Duran, J., Reisinger A., "Sands, Powders, and Grains: An Introduction to the Physics of Granular Materials".

3.Rodhes, M (editor),"Principles of powder technology", John Wiley & Sons,

4.Fayed, M.E., Otten L. (editor), "Handbook of powder science & technology", second edition, Chapman & Hall,

5.Bagnold, R.A., "Physics of Blown Sand and Desert Dunes", First Springer edition, 1971,

6. F. Thummler and W. Thomma, "The Sintering Process," Metallurgical Reviews No. 115, June (1967).Manufacturing Engineering and Technology fifth edition

7.T. Vreeland, Jr., P. Kasiraj, Thomas J. Ahrens, and R.B. Schwartz (1983). "Shock Consolidation of Poders--Theory and Experiment. Proc. 1983 Materials Research Society Meeting.

8.M.A. Meyers and S.L. Wang (1988). "An Improved Method for Shock Consolidation of Powders." Acta Metall. Vol. 36 No. 4, pp 925-936.

9.Marius Vassiliou, C. G. Rhodes, M. R. Mitchell, and J. A. Graves (1989), "Metastable Microstructure in Dynamically Consolidated g Titanium Aluminide," Scripta Metallurgica 23, 1791-1794.