Analyzing the Properties of Nimonic 80 using Cryogenic Treated and Untreated Tool

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ABSTRACT:

This project is analysing the nimonic 80 properties by using cryogenic treated tool and untreated tool (Drill bit). It is a conventional machining process (Drilling) for a tool and work piece have a direct contact. A tool (4mm) drill bit is used for the machining process. A tungsten carbide tool (drill bit) 4mm is used to make a drill on the work piece and posterior of tool can be treated in cryogenic process, then make another drill in work piece. Finally all the dimension test, circularity test and hardness test has been taken for both tool and work piece. Nimonic 80 is a super nickel based alloy, and it has a low creep and high temperature with stand character. The composition of nimonic 80 (50% nickel, 20% chromium, titanium and aluminium are additives). Because of the presence chromium metal, it won't get corrode during cold condition based machining process. Cryogenic treatment is a process to study the tool (or) work piece character and properties change under the temperature (-180^{o}c). Mostly it is used to preserve food materials and also used as a fuel for the Aerospace vehicle.

INTRODUCTION:

In these traditional machining process tool can be classified into various type of operation based on the tool. Such as drilling, milling, knurling etc… A machining is a board term used to describe removal of material from a work piece. Then a cutting tool can be classified into the following categories:

1. Single point cutting tool
2. Multi point cutting tool

The material removal from work piece process includes (drilling) also. A cutting edge of tool is harden than the metal to be cut. In drilling process wandering effect will plays a major role, due to it a diameter of hole (or) drill surface varied. Drilling is a cutting process that use a drill bit to cut a hole of circular cross section in solid material. A drill is a multi point cutting tool process. It used to produce a hole in a work piece. The various type of drill used are:

1. Hand drill
2. pistol- grip drill
3. Hammer drill
4. Cordless drill, and
5. Geared head drill process

In some of the machining process tool can be used for machining after the cryogenic treatment. In that they got a good finish of machining surface.

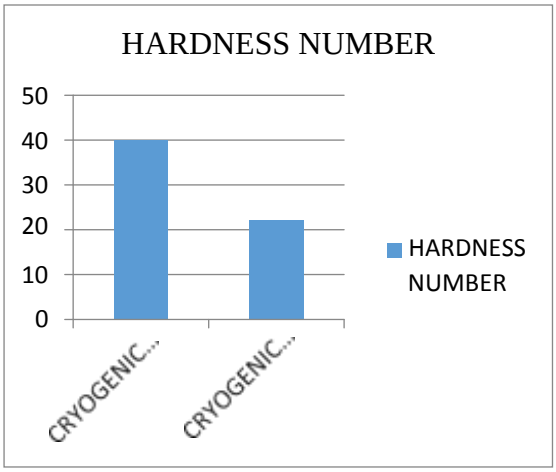
Experimental and Testing Results:

We took a drill bit and done machining process (hole) in nimonic 80 (work piece). Posterior of that tool (tungsten carbide) can be dipped into the liquid nitrogen at -180 for 12hrs. This method is consider as a cryogenic heat treatment. After cryogenic treatment a tool

behaviour had been changed and metal removal also varied then compare both drilled holes. We done some mechanical testing there are:

1. **Hardness test:**

Hardness test (Rockwell hardness) had been taken for both tool and work piece by using diameter head Indentor. A treated tool has a low hardness value compared to untreated tool. The result of hardness test can be shown in fig-1



2. **Circularity test:**

The dimensional circularity test had been taken by (ARCS vision measurement software). Inter and exit diameter can be varied

Exit Diameter			
Centre X 28.470	Centre Y 10.41	Centre r 30.331	Centre t 20.175
Centre Y 0.000	Radius 1.999	Diameter 3.997	Circumference 12.557
Area 12.548	Roundness 0.060385		

due to the wandering effect of tool. Both the treated and untreated hole circularity test result had been shown in table (1) and table (2)

Table (1)

Inlet diameter			
Centre X 28.72	Centre Y 10.446	Centre 30.328	Centre 20.148
Centre Y 0.000	Radius 2.053	Diameter 4.105	Circumference 12.898
Area 13.223	Roundness 0.016634		

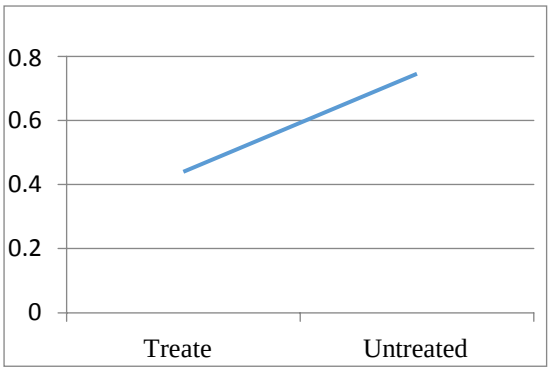
Table (2)

Inlet diameter			
Centre X 46.877	Centre Y 9.650	Centre r 47.860	Centre t 11.632
Centre Y 0.000	Radius 2.000	Diameter 3.999	Circumference 12.564
Area 12.562	Roundness 0.044540		

Exit diameter			
Centre X 46.864	Centre Y 9.656	Centre r 47.849	Centre t 11.643
Centre Y 0.000	Radius 2.056	Diameter 4.113	Circumference 12.920
Area 13.284	Roundness 0.027283		

3. **Surface Roughness:**

A surface roughness plays a major role in all machining process. It can be taken by (kasoka laboratory Japanese manufacturing make). For both treated and untreated drilled holes. Then a Ra value can shown in fig 2



CONCLUSION:

A cryogenic treated tool and untreated tool were taken for the machining process. A cryogenic treated tool was dipped into liquid nitrogen at -180 for 12 hours. Both treated and untreated tool was used to make a drill on work piece. Then testing process like (Dimension test, circularity test and hardness test) had been taken. A circularity test done by VRRC test machine. Hardness test (Rockwell hardness) is used to check the tool hardness difference between posterior of cryogenic treatment and before it's treatment and surface roughness (RA) is also consider as a factor to check treated and untreated tool surface finishing. A treated tool surface roughness is better compare with untreated tool surface roughness. So I concluded a cryogenic treated tool give a good surface roughness result for machining process.

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