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Component Crack Analysis of high pressure die casting aluminum alloy (Alsi9cu)

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ABSTRACT:

Crack Analysis of the high pressure die casting Alsi9cu aluminum alloy component. The study is aimed in the project or research work. Especially industry based problem is decides to study in detail Technical solution for minimizing cracks in casting parts and find out the causes of crack failure with solution of problem, is decided to work out during this project. By enhancing the Quality and reducing the rejection of casting component which in turn will be profitable for both the industry as well as the customer is planned in the proposed study.

Keywords: Scanning Electron Microscope, Microstructure of material,

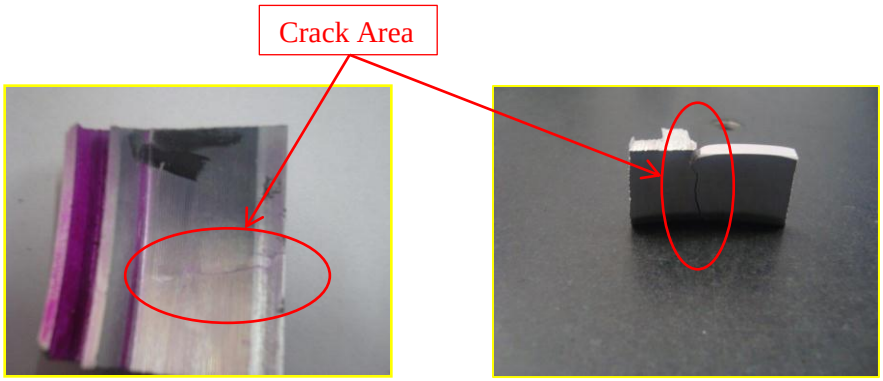
1.INTRODUCTION

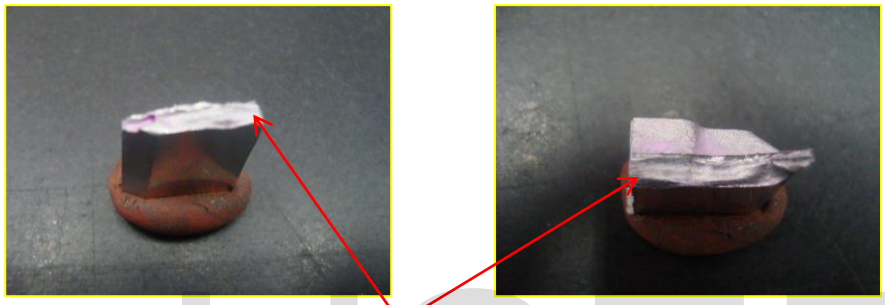
MATERIAL - Alsi9cu aluminum alloy

Introduction Aluminum matrix composites reinforcement with carbon fibers are perspective engineering materials. Main advantages of those materials are: high stiffness, specific strength as well as low coefficient of thermal expansion and high coefficient of thermal and electric conductivity. Potential area of application them could be aerospace, automotive, and also electronic industry. The aluminum alloys used for composites must have appropriate strength. The aluminum carbide promotes wetting, but it is brittle and hydrophilic phase, decreases corrosion resistance and strength of composite materials.

The AC AlSi9CuX series (Al-Si-Cu) casting alloys are widely used for automotive industry. The AC AlSi9CuX series alloys are used in the production of engine components such as cylinder blocks heads and several parts of car suspension. The use of aluminum alloy castings in this application is growing, replacing grey iron in many demanding applications.

2.PROBLEM - Appeared the cracks in component of Alsi9cu alloy during the assembly process. Due to this casting got rejected at customer end. That condition not suitable for customer is planned and as well as for supplier company. This analysis is required for find out the causes of crack or failure. By this analysis we confirmed that cause of crack is extra load applied or process related.





Cracked surface of samples

3. APPROACH

In this project we experimentally investigated the cracked surfaces of component. For cracks analysis we used following methods.

A. Chemical Composition :-

ALLOY	Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Pb	Sn	Ti[h]	Other [aq]		
												Each	Total	Aluminum
AlSi9Cu	8.0-11.0	9.6-1.2	2.0-4.0	0.5	.05-0.55	0.15	0.55	3	0.35	0.15	0.25(0.20)	0.05	0.25	Remainder

Chemical composition report was o.k.

B. Mechanical properties checking

Required hardness > 80 HBW
Actual hardness– 90 HBW -OK

C. Crack failure analysis on SEM (Scanning Electron microscope).

We used to two method for analysis.

- Micrograph of crack surface.
- Microstructure Analysis of samples.

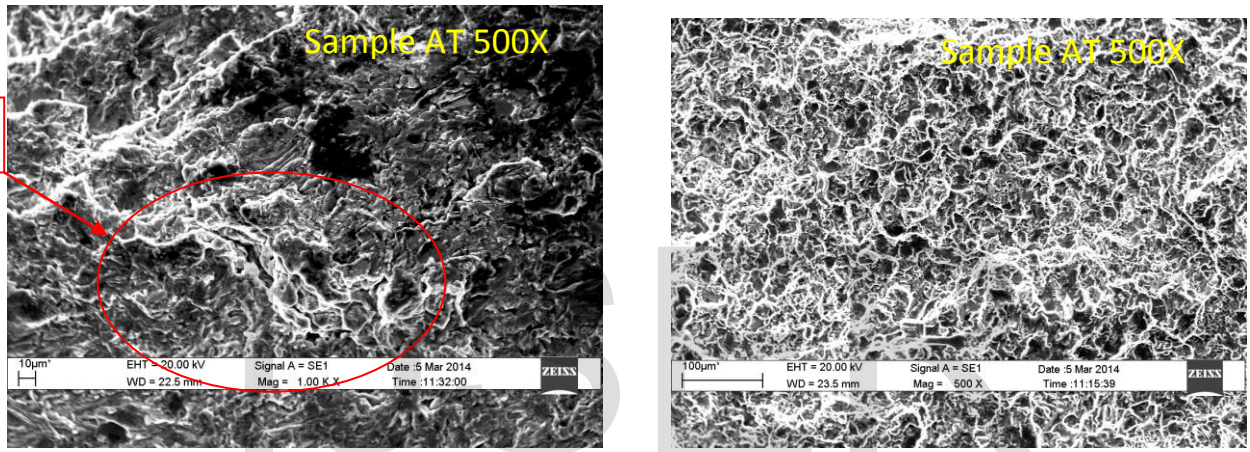
Micrograph of crack surface:-

In this experiment we analysis the both cracked surface on SEM at 500 X.

Based on these SEM images we try to understand the crack types and properties of crack.

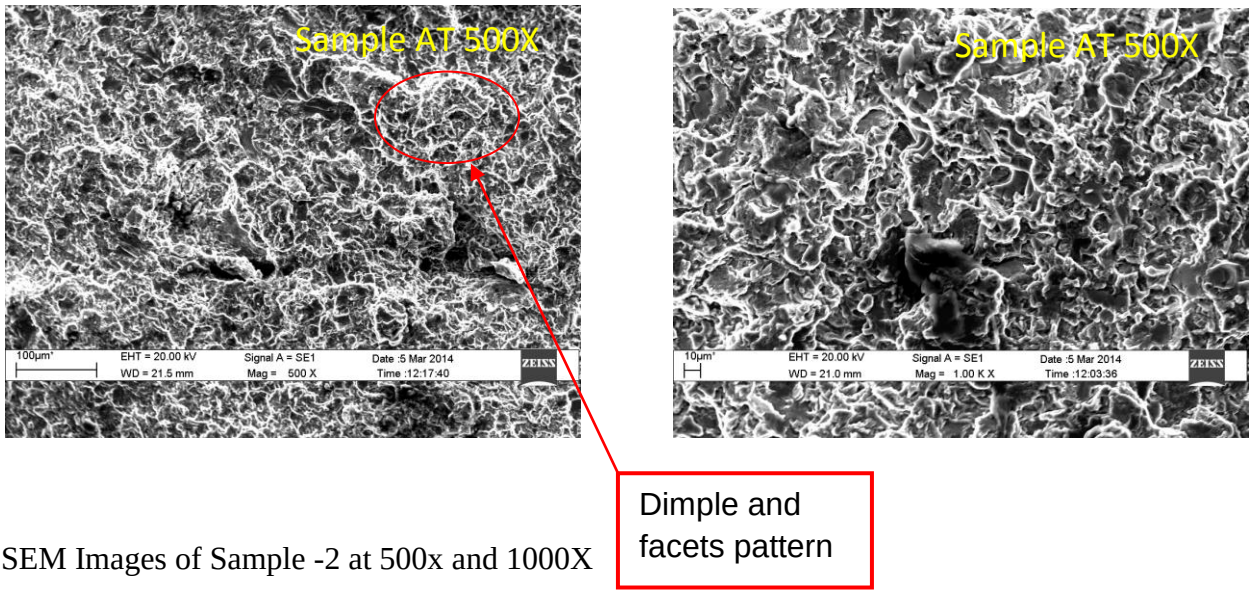
Scanning Electron Microscope (SEM) was used to analyze the cracked surface profile to decide the types of cracks.

SAMPLE 1

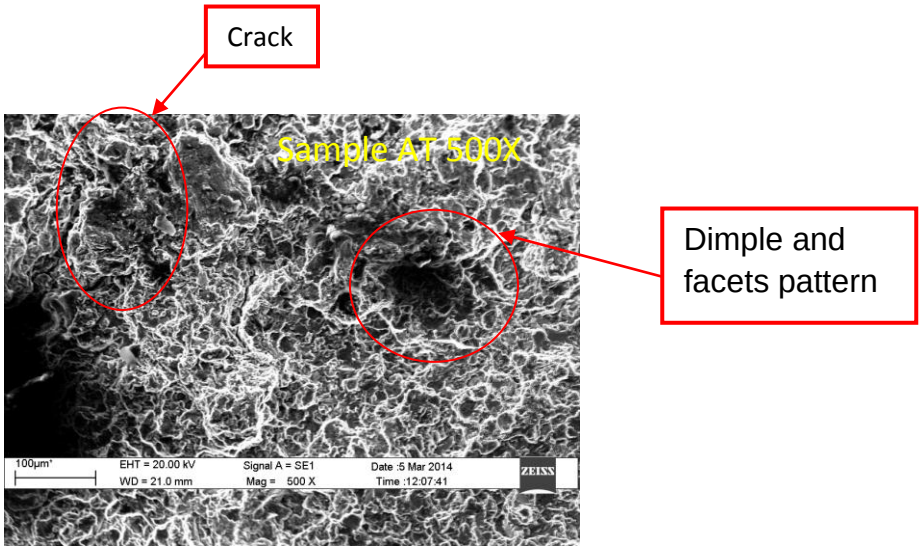


SEM Images of Sample -1 at 500x and 1000X

SAMPLE 2



SEM Images of Sample -2 at 500x and 1000X



SEM Images of Sample -2 at 500X.

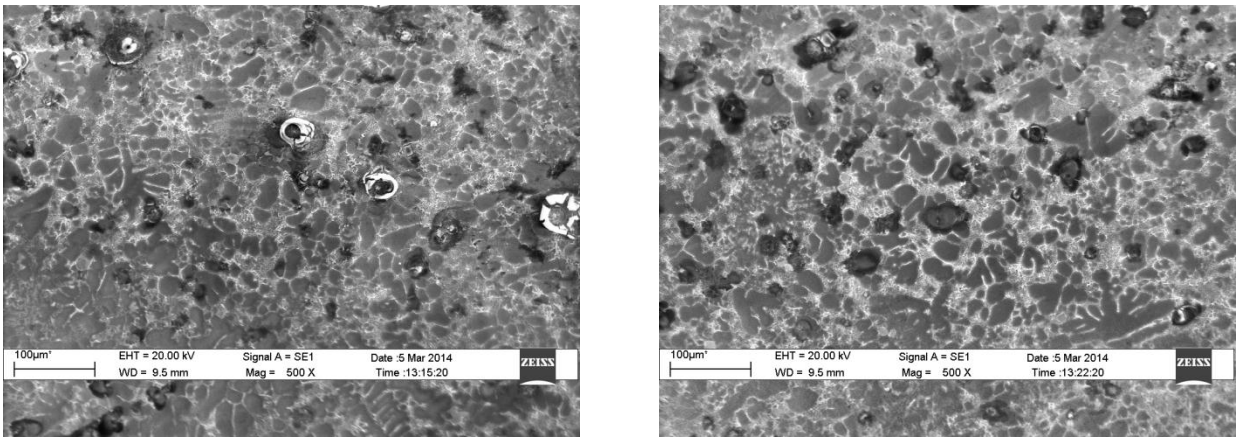
Discussion of micrograph

Faceted fracture surface signifying Brittle pattern. Fracture surface shows dimple and facets pattern. Both Fracture surface shows internal cracks. The reason for failure may be due to internal cracks

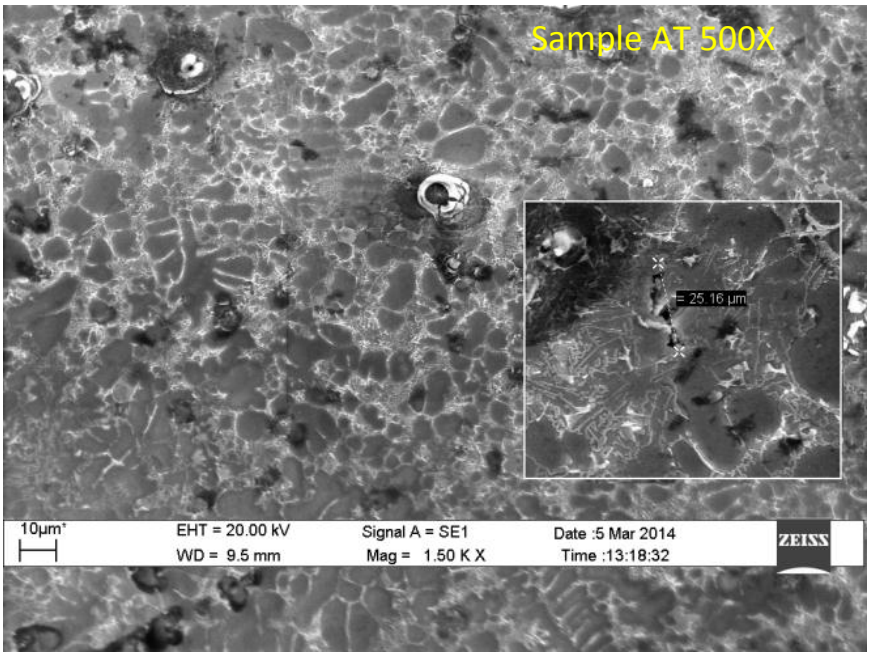
Microstructure Analysis

Scanning Electron Microscope (SEM) was used to analyze micro of the cracked surface . First of all, for proper testing on SEM these specimens were manually polished and etched by an HF etchant.

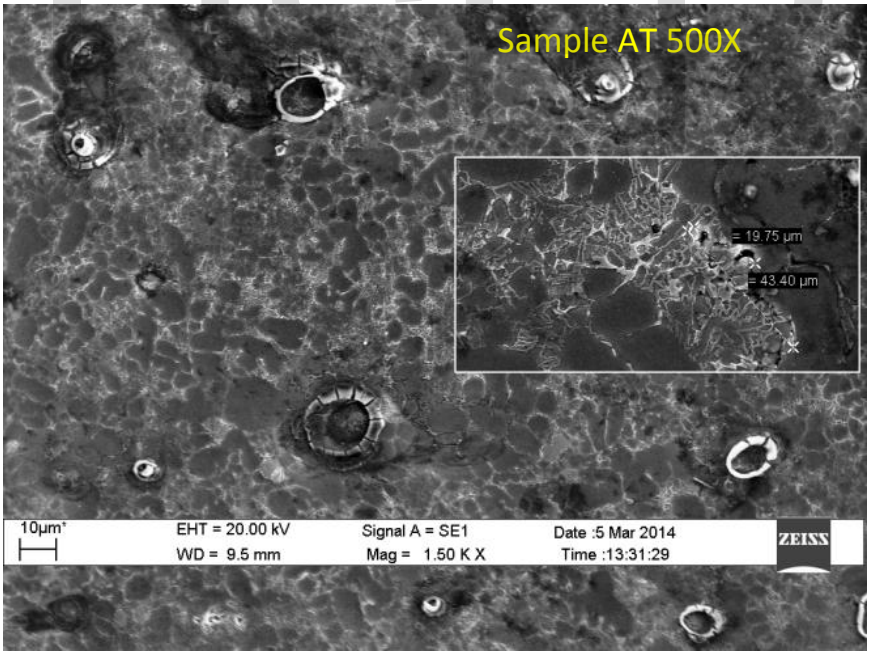
MICROSTRUCTURE OF SAMPLES.



SEM image of sample at 500X



SEM image of micro porosity



SEM image of micro porosity

Discussion of microstructure

- Non uniform microstructure.
- Coarse distribution of silicon and CuAl2 in matrix of aluminum.
- Visible surface porosity and oxide inclusions found on sample surface.
- Reference for microstructure: - ASM international handbook.

4. CONCLUSION:-

Extra Load is not responsible for Crack appeared. This Crack failure took place due to manufacturing process variations. Process parameters variations create the internal cracks, Oxide inclusion and micro porosity on surface. These defects Leads to crack.

5. SOLUTION:-

We required standardization (optimization) of process parameter for entire cycle of manufacturing. By enhancing the Quality and reducing the rejection of casting component.

6. ACKNOWLEDGEMENT

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Thanks to my colleague Mr. Bhoodev Sharma for support.

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2. L. Bäckerud, G. Chai, Solidification Characteristics of Aluminum Alloys