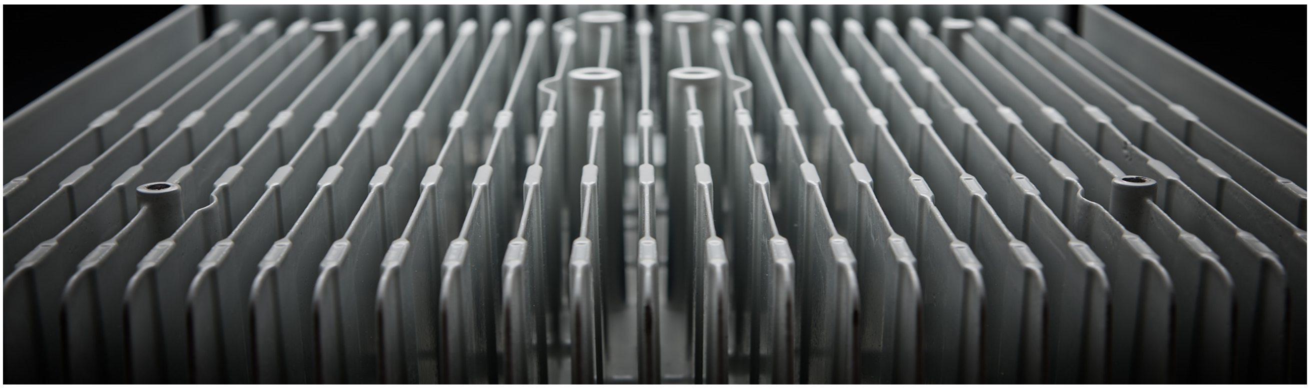
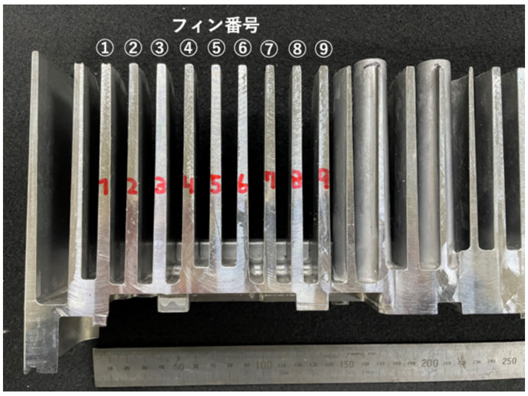


Microstructural analysis of heatsink fin sections cast by Comptech's Rheocast method reveals

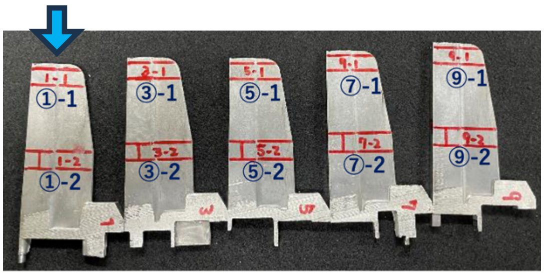
We analyzed the microstructure of thin-walled fin sections with a height of 105 mm, an upper width of 0.8 to 1.0 mm, and a slope of 0.5 to 1° produced by Rheocast. These results were obtained by providing samples cast by the Rheocast method developed by Comptech to UBE Machinery, Inc. for microstructure analysis by the company.

■ Observation site

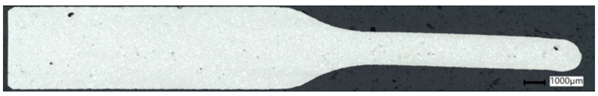
Alloy: EN42000
(100% recycled material equivalent to A356)
Composition: AlSi:6.95%, Fe:0.3
No addition of Sr or other microstructure improvement elements



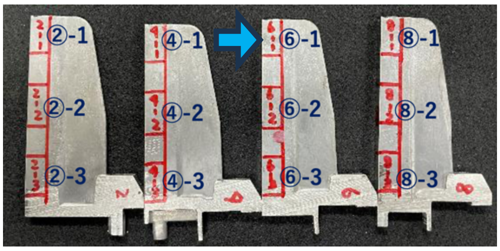
Observation direction



Example) Cross section of tissue observation (1)-1

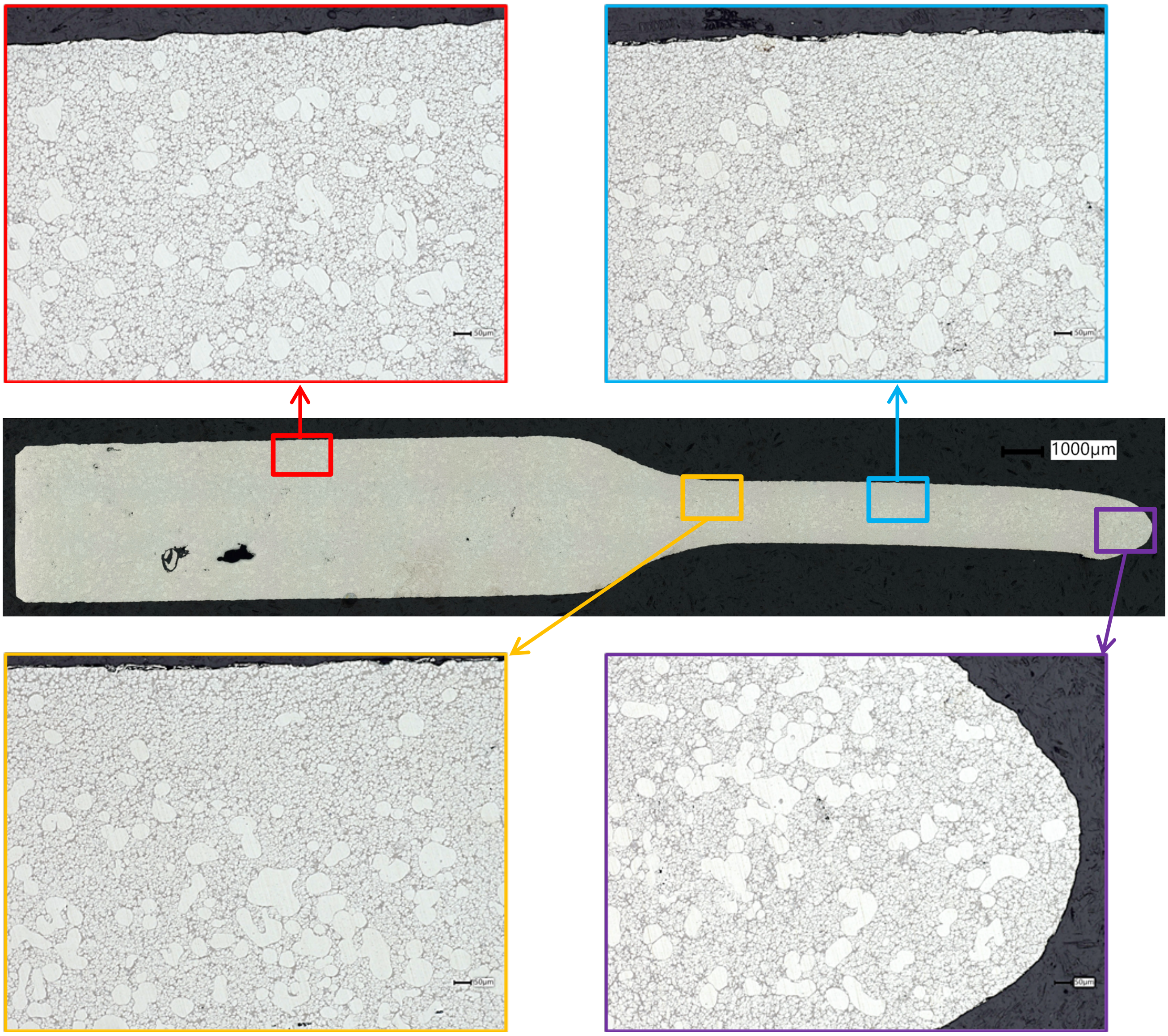


Observation direction



Example) Microstructure observation cross section (⑥-1)

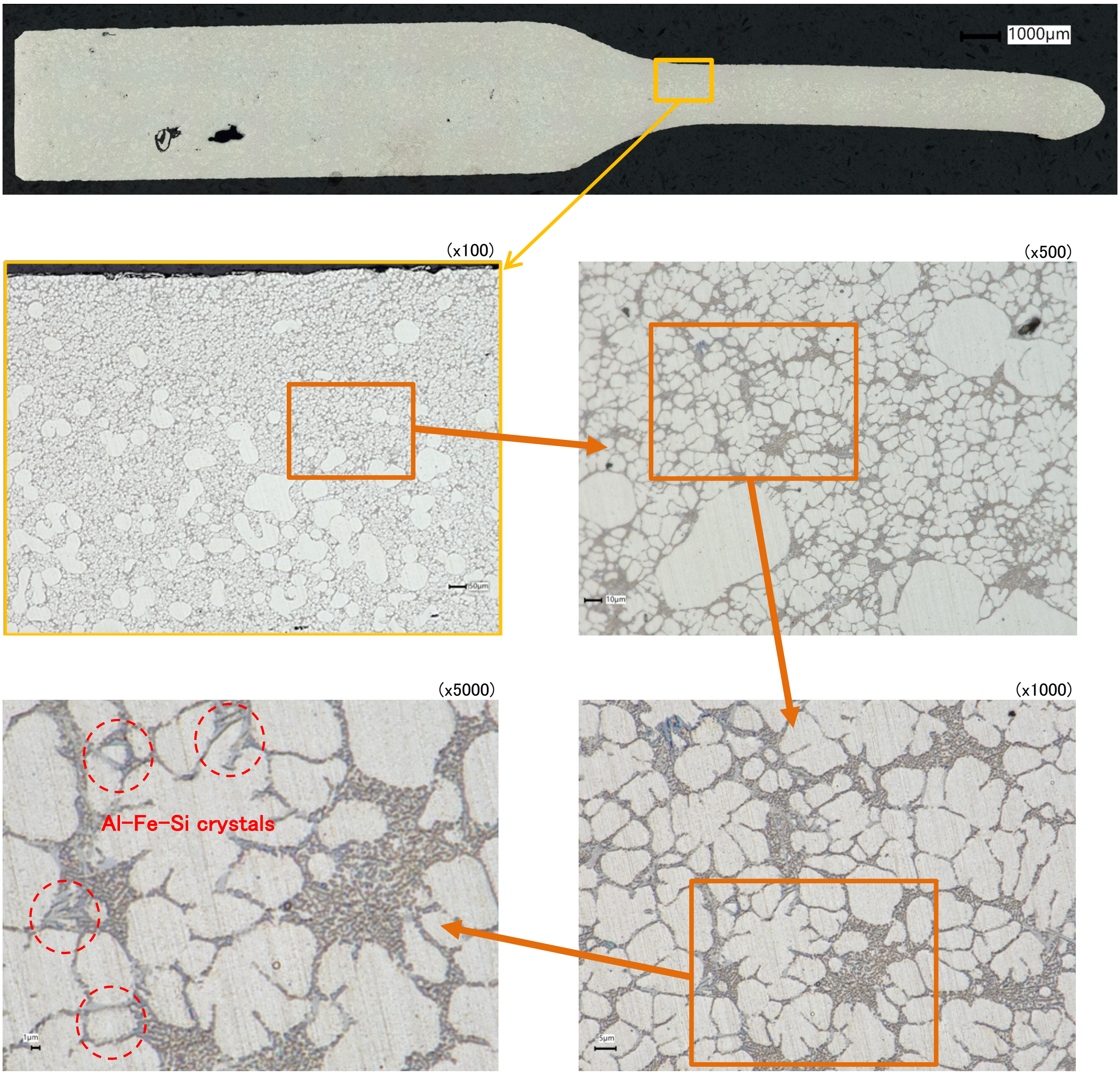
■ Microstructural observation of fin cross section under normal magnification (x100 level)
(Microstructural observation cross section ⑨-1)



■ Microstructure Characteristics (1) (Results of low-magnification observation)
From the base of the fin, which is about 3 mm thick, to the tip of the fin, which is about 1 mm thick, the entire area is composed of a uniform structure with the following characteristics:
- Primary aluminum spherical particles of about 50 μm
- Extremely fine α-phase aluminum crystallized in the gaps between the above spherical particles
- Eutectic silicon structure (gray area) crystallized in the gaps between the above spherical particles and extremely fine α-phase aluminum

Although some air entrapment and shrinkage cavities were observed, the metal was packed uniformly without uneven deposition, so we can expect stable quality within the same product.

■ Microstructure observation of fin cross section by high magnification (x5000)
(Microstructure observation cross section ⑨-1



■ Characteristics of microstructures (2) (results of high-magnification observation)

- The extremely fine α-phase aluminum that crystallizes in the gaps between the spherical particles was found to be secondary crystallized extremely fine petal-like dendrites of a few μm in size.

- Furthermore, it was found that the eutectic silicon that crystallizes in the gaps between the spherical particles and the extremely fine α-phase aluminum takes on an extremely fine granular or fibrous form.

■ Findings from research partner UBE Machinery Co.

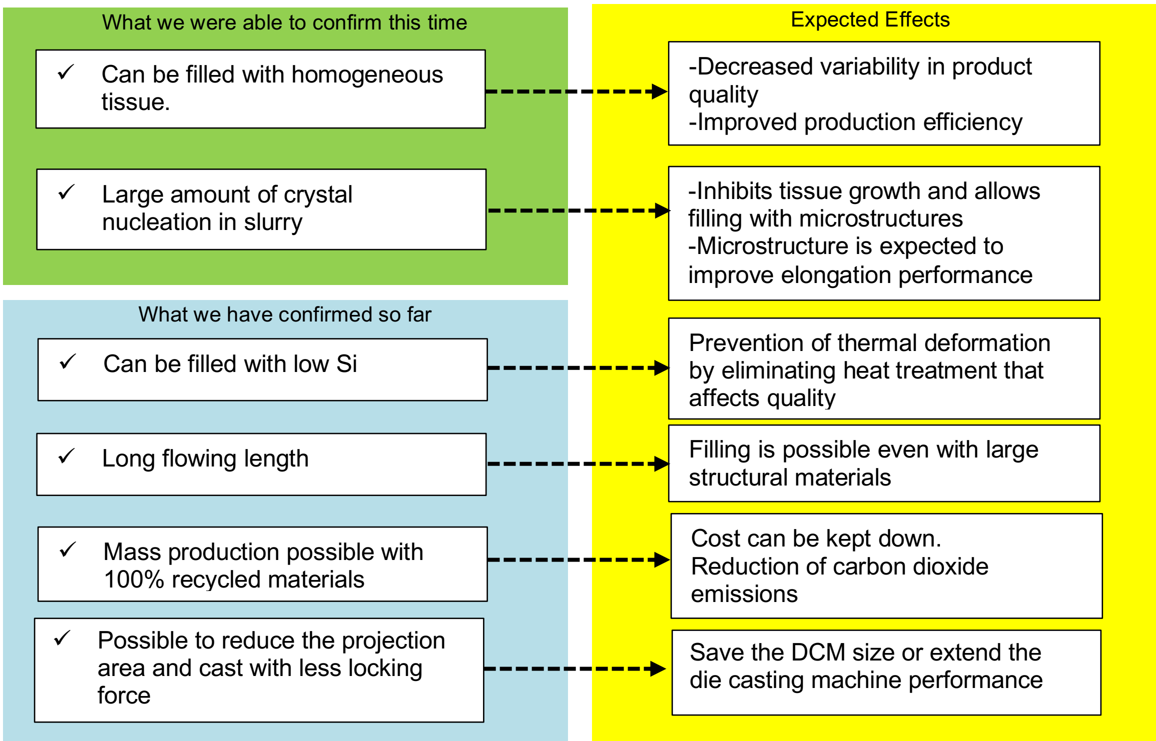
- In conventional semi-melt and semi-solid forming [1], the liquid phase with a low melting point is filled first, so the eutectic Si phase tends to segregate in the thin-walled fin section.

- The reason for the uniform fine microstructure is assumed to be that a large number of crystal nuclei are generated in the pouring ladle, which crystallize in the sleeve or during mold filling, or immediately after the filling is completed.

- The eutectic Si structure is very fine and the segregation of eutectic Si is suppressed as described above, so the tensile properties of the die-cast material, especially the elongation value, may be greatly improved even in the non-heat treated state. Therefore, it is expected to contribute to the improvement of impact absorption energy, which is an issue for large body and chassis die casting.

■ Summary

Based on the above analysis and discussion, Comptech's Rheocast method is expected to



When applying this method to large body/chassis components, known as Gigacast, a Gigacast machine which have sufficient filling force might be more optimal.

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