Stir Casting and Atmospheric Pouring of A380 Al Alloy with Sr Addition

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Abstract.

The actual trend in order to supply automotive and aeronautical industries is the enhancement of mechanical properties of Al-Si alloys by modifying chemical composition, heat treatments and novel forming process. Nowadays is recurrent the development of components reduced in weight replacing in many cases of typical heavy steel and cast iron applications.

The A356 alloy with non-dendritic microstructures has been widely developed; the advantage of this alloy is the adequate freezing range and solid fraction for thixoforming and rheocasting, due to the Si content near to 7% in weight. However, in A380 alloy at 9% of Si, a decreased freezing range and less solid fraction are available.

Mechanical stirring have been performed for a binary alloy with 8.79%w of Si and A380 commercial alloy at low cooling rate with 100 ppm of Sr, 0.33 of solid fraction, 28.33 s^{-1} of shear rate and atmospheric pouring in a ductile iron mold moreover both alloys were rheocasted in a laboratory equipment. The control of solid fraction during cooling was accomplished by a thermodynamic model that calculates the real percent of solid fraction of the alloy during solidification as a function of temperature.

The microstructural characterization in both alloys shows a globular α-Al phase surrounded by fine Si eutectic structure. The Si distribution in the binary alloy obeys the high content in the eutectic structure and less in the primary solid. In commercial alloy, Cu and Fe are located outside from α-Al phase and eutectic structure forming coarse precipitates as shown in Figure 1, were High Resolution SEM-EDS micrographs and mapping are presented. Table 1 reports the chemical microanalysis. The mechanical behavior of the alloys by tension tests are presented.

TABLE 1. MICROANALYSIS OF STIRRED A380 ALLOY

% weight	O-K	Al-K	Si-K	Cl-K	Fe-K	Cu-K	Sr-L
380R(2)_pt1		100.00					
380R(2)_pt2		97.54				2.46	
380R(2)_pt3	12.78	35.90	1.96	2.05		47.23	0.09
380R(2)_pt4		71.16	11.82		15.26	1.76	
380R(2)_pt5		85.91	11.51			2.58	

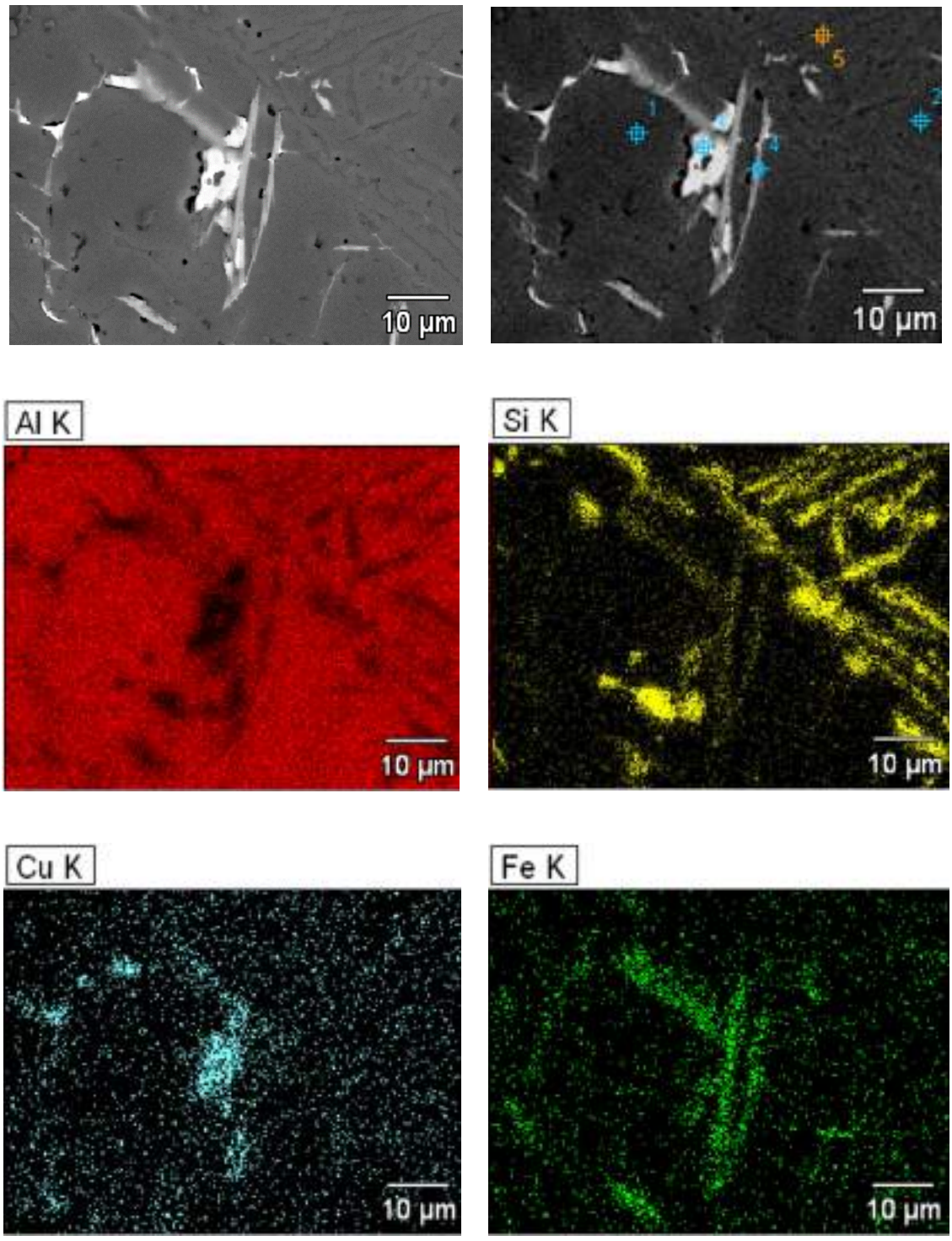

Figure 1. Micrograph and EDS of stirred A380 alloy showing globular α phase rich in Al, distribution of Si in eutectic structure and location of Cu and Fe outside of primary solid and eutectic structure.