A typical compressor crankcase made up of grey cast iron is developed for truck applications by optimizing the shell casting process with superior mechanical & metallurgical properties. This crankcase requires high wear resistance and increased tensile strength combined with good machinability properties. When the product was developed it did not meet the required material specification. Even though many trials were being carried out, some of the properties were adhered and some of them weren’t particularly metallurgical properties like ferrite content and desired graphite flake size. Also, the method to differentiate between steadite & ferrite is not so precise. This deteriorates product performance and dissatisfies the customer. This practical problem is addressed here and the bottleneck for the problem is identified and completely eliminated after developing the desirable method of casting; and the etchant solution is developed for differentiating and quantifying the steadite and ferrite micro constituents under an ordinary metallurgical microscope.

The difficulty in the metallography of gray cast iron lies in the differentiation of ferrite and iron phosphide eutectic (steadite) microconstituents by using normal etchant like nital, picral and both these phases appears as bright under normal light microscope. Hence, it is difficult to find out the relative amounts of phases, either photo micrographically or using sophisticated image analysis software. In general industry practice, the samples are etched with 2% to 3% nital for quantification of ferrite, steadite and cementite plus carbide particles under optical (light) microscope. This method of inspection requires high skill to differentiate the ferrite and iron-phosphide eutectic (steadite) microconstituents and also sometimes it leads to misinterpretation. This led to the development of a novel etching method called Selenic etchant, in which the steadite and ferrite constituents are differentiated at 100 % confidence level and the precise quantification of phases were done.

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Fig. 1: The microstructure (x100) of gray cast iron etched with 3% nital reveals presence of ferrite and steadite microconstituents as same colour under normal microscope.

Fig. 2: The microstructure (x1000) of gray cast iron etched with Selenic composition reveals presence of ferrite as white or yellow colour and steadite as green colour.