SZALAY, Zsolt: Increase in accuracy of porosity identification with non-destructive testing methods in aluminum-silicon alloy castings

NEW SCINETIFIC RESULTS

1. A density difference of 0.2% caused by porosity in AlSi12(Cu) alloy castings can be detected by the Archimedes method under laboratorial circumstances (min. ±0,1 mg mass measurement accuracy). **I stated that (despite the industrial practice) density measurement results of different casting series are not comparable from point of view of porosity content, due to the allowed deviation in chemical composition of the castings.**

2 I verified that the size of the smallest detectable pore is not only determined by the resolution of the radiographic system, but also limited by the size of pore related to the target width. According to my measurements the detection of a pore in case of 5% pore diameter/target width ratio is doubtful.
I worked out a new method for pore size determination based on the comparison of intensity curves. This method - compared to the visual methods containing lots of subjective errors - is much more objective so that it is applicable for examination of casting series. As differentiation between grayscales is rather difficult for human eye, the comparability of intensity curves enables a more precise pore size determination.

3 The neutron radiography method was not applied up to now for porosity detection. I examined the applicability of neutron radiography for detection of porosity in Aluminium-alloy castings.
I stated that the dissolved hydrogen in the melt - that causes porosity – escapes from the casting by diffusion right after the casting procedure. In the lack of hydrogen, porosity cannot be determined with neutron radiography in this state.
I proved with experimental results that the application of a special "water saturation" process enables water infiltration into the pores having exit channels to the macrosurface, generally in the near-surface layer. The contrast of the neutron radiography images taken on porous casting prepared in the above manner is significantly higher than the X-ray radiography images, so the method is efficiently applicable for detection of pores having exit channels to the surface.

4. **I verified that in case of ultrasonic examination using pulse-echo straight-beam method the detection of microporosity is effective with measuring the loss of the backwall-echo amplitude.** I demonstrated that in extreme situation when lots of pores are concentrated in a small region, the total backwall-echo can disappear.