

Standard for internal defects inspection in synthetic sapphire

We suggest to add the chapter devoted to internal defects inspection in synthetic sapphire to the existing ISO 14368-3 standard during revision, or create a new standard (ISO 14368-5).

1. Synthetic sapphire is widely used in watch industry (watch-glasses), LED production (substrate material for semiconductor layer) and in quickly emerging smartphone application (screen cover). It is the hardest transparent crystalline material after diamond.
2. The quality and value of sapphire items are defined according to three parameters: dimensions, surface quality and internal defects. The internal defects include yield-impacting crystal defects such as impurities, cracks, bubbles or inclusions, which become trapped during crystallization stage.
3. Actual standard ISO 14368 covers dimensions (14368-1) and hardness (14368-3) of watch-glasses, and their assembly to watch case (14368-2). The internal material defects are not substantially covered and left to subjective judgement: *"...acceptance or rejection [of defects] is subjective as it depends on human factors which cannot be rigorously quantified"*. The lack of a uniform quality standard leads to disordered product specifications and need for multiple cross-checks within the supply chain.
4. With sapphire production getting more and more automated, the industry required an observer-independent quality grading system. In 2014 the SEMI community set a task force to establish one for LED sapphire (see www.semi.org: *Sapphire Single Crystal Ingot Task Force*).

Scientific Visual is involved in this group as expert in automatic sapphire inspection. It contributes by defining quality specifications and inspection methods for internal defects. The LED sapphire standard is now going through ballot stage; the standard approval is expected in December 2015.

5. Sapphire material used in watch and LED industry is identical and its inspection methods are similar. The acceptance thresholds for watch industry are less strict because only visible defects matter. Therefore, a logical step will be to expand LED grading system to inspection of watch-glasses.

The common standard will:

- remove subjective grading and streamline the supply chain, notably for Swiss watch manufacturers
- offer a guideline for the downstream enterprises in cutting, grinding and polishing
- be a reference between businesses, which reduce misunderstanding and resource waste
- increase production margin for sapphire manufacturers by eliminating multiple cross-checks from the supply chain.

For more details on the proposed standard please contact:

Ivan Orlov & Michael Watts ivan.orlov@scientificvisual.ch

Scientific Visual SA, Lausanne | +41 21 693 05 48 | www.ScientificVisual.ch