AUTOMATED SPECTRAL DIAMOND INSPECTION

Problem – Challenge
The watch and jewellery industry uses large quantities of polished colourless natural diamonds (often of small size) for their luxury products. They have a high interest to separate such diamonds from other kinds of colourless diamonds, such as natural diamonds containing chemical impurities which have been treated to appear colourless, colourless synthetic diamonds, or colourless diamond imitations. So far, there was no technology to automatically separate such diamonds. The separation is therefore performed manually, being very time-consuming and costly.

Solution
The University of Basel (Michael Steinacher, Institute of Physics) and the Swiss Gemmological Institute SSEF have joined their expertise and developed the first device which can analyse very large quantities of small colourless diamonds at low cost. A Raman probe identifies all possible diamond imitations and rejects them. Then, in order to identify and reject treated natural or synthetic diamonds, a highly sensitive spectrometer checks the short wave ultraviolet (SWUV) transparency of each diamond. The average sorting speed is 4'000 stones per hour. The devices are now marketed and sold by the newly formed company SATT GEMS. They are already operating at major Swiss diamantaires and major Swiss watch and jewellery groups.

TUNABLE OPTICAL LENSES

Problem – Challenge
Traditional optics are based on solid glass or plastic lenses, which are moved back and forth to focus or zoom. A very old but successful system, however, is completely different: the eye! It consists of an elastic lens material, which is bent in order to focus. Optotune has developed and patented a series of lenses that basically copy the principle of the eye.

Solution
Optotune’s focus tunable lenses are shape-changing lenses based on a combination of optical fluids and a polymer membrane. The core element consists of a container, which is filled with an optical liquid and sealed off with a thin, elastic polymer membrane. A circular ring that pushes onto the center of the membrane shapes the tunable lens. The deflection of the membrane and with that the radius of the lens can be changed by pushing the ring towards the membrane or by exerting a pressure to the outer part of the membrane or by pumping liquid into or out of the container. Optical systems can be designed more compact, oftentimes with less lenses and usually with less or no translational movement. Accordingly, there is no more need for expensive mechanical actuators. Less movement also leads to a more robust design. The materials employed are lighter than glass, saving overall weight. Less movement and weight also means less power consumption and that the response time of systems with tunable lenses can be very low, in the order of milliseconds. Less optical parts are moved combined with the tunability of the radius during operation results in reduced tolerance sensitivity and thus higher yield rates.