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Vitrography to direct light rays from a camera flash

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ABSTRACT

This disclosure describes techniques that isolate a flash module from a camera module and enable both to be housed underneath a single piece of transparent material such as glass. Using vitrography, small deformations are fabricated within the glass bulk surrounding the flash module. The boundary between the bulk and the vitrographed glass prevents light rays from traveling towards the camera module from the flash module. Compared to current techniques used to isolate the flash module from the camera module, the disclosed techniques reduce the cost and complexity of device assembly and produce better device performance and aesthetic.

KEYWORDS

- Vitrography
- Camera
- Flash
- Total internal reflection
- Refractive index

BACKGROUND

Flash modules in devices such as smartphones, tablets, or other devices that include a camera emit light to illuminate a scene while capturing an image. The flash module is used in conjunction with the camera module. If light originating from the flash module propagates towards the camera module or other components/sensors, e.g., through total internal reflection, the camera module can get flooded with extraneous light, resulting in washed out or otherwise suboptimal images. To prevent wash-out, the flash module is surrounded by a solid metal or plastic ring that prevents light from the flash from entering the camera module. Besides being unaesthetic, the ring surrounding the flash module adds cost and complexity during device assembly.

DESCRIPTION

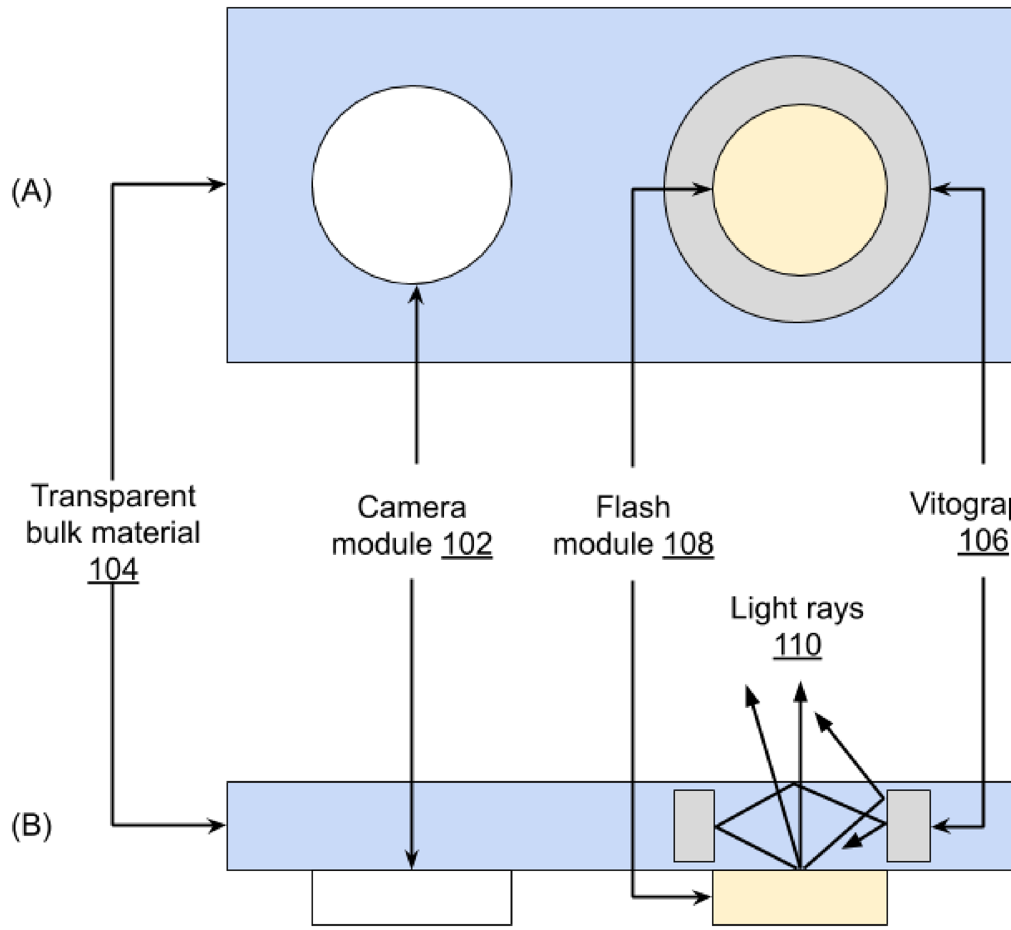

Fig. 1: Vitrography to direct camera flash light rays: (A) Bottom view (B) Side view

Fig. 1 illustrates the use of vitrography to direct light rays from a flash away from the camera and towards the subject. Vitrography is the process of introducing bubbles, fractures, or deformations in transparent bulk material such as glass. Fig. 1(A) and Fig. 1(B) are respectively bottom and side cross-sectional views of the camera module (102) and the flash module (108) housed underneath a transparent bulk material (104). The transparent bulk can be made of materials such as glass, sapphire, acrylic, polycarbonate, etc. Small deformations, bubbles, or fractures are fabricated using vitrography (106) in a region of the transparent bulk surrounding the flash module. The refractive index of the vitrographed material surrounding the flash module is thereby altered. The diameter of the vitrographed region is larger than the flash module diameter, e.g., by about 0.4-0.8 mm. When the flash illuminates, light rays (110) from the flash module either travel to the subject or reflect off the bulk-vitrography boundary back to the flash module. This minimizes the amount of light that travels towards the camera module from the flash module, thereby reducing the risk of flooding.

The disclosed techniques can be used in any device that includes a camera, including laptops, tablets, smartphones, other handheld devices, etc. The techniques enable the integration of a flash module and a camera module underneath a single piece of transparent material without the use of a light-blocking ring. Compared to current flash-camera light isolation techniques, the disclosed techniques reduce the cost and complexity of assembly and produce better performance and aesthetic.

CONCLUSION

This disclosure describes techniques that isolate a flash module from a camera module and enable both to be housed underneath a single piece of transparent material such as glass. Using vitrography, small deformations are fabricated within the glass bulk surrounding the flash module. The boundary between the bulk and the vitrographed glass prevents light rays from traveling towards the camera module from the flash module. Compared to current techniques used to isolate the flash module from the camera module, the disclosed techniques reduce the cost and complexity of device assembly and produce better device performance and aesthetic.