






Reveal of Beryllium in artificially coloured gems


 Sample
Gemstones

 Limits of Detection
<5 ppm

 Elements of interest
Be, Al, Si, Fe, Cr

 Spatial resolution
100 μm

 Mode of analysis
Individual points

 Measurement rate
20 Hz

Corundum is a crystalline form of aluminium oxide (Al_2O_3) which has two gem varieties - sapphire and ruby. Ruby is usually in a shade of red due to the presence of chromium, while for sapphire the blue is the best-known colour. Naturally coloured yellow, orange and padparadsha (pinkish orange) sapphires are rare and so their price on the market is very high. Since 2001 such coloured sapphires treated by a new technique in Thailand had been entering into the marketplace unannounced. It was discovered that this new process is the diffusion of beryllium into ruby and sapphire at high temperatures in an oxygen atmosphere. This process can also enhance other colour properties - conversion of bluish rubies to a fine red colour, reduction of blue in dark blue sapphires etc.

LIBS provides fast and easy Be detection in gemstones while meeting the requirement of relatively low initial and running costs.



Fig.1. Various types of gems. From left: Sapphires, Emerald, Ruby

Moreover, with the capability to detect every element of interest simultaneously, LIBS brings complete information about the composition of the stone and so it enables one to characterize it even deeper (Fig. 3). In the Fig. 2, it's shown that it's easily possible to detect Be which is observed in the artificially treated sapphire - Sapphire 2 (orange). Meanwhile the colour of Ruby and Sapphire 1 (blue) are of natural origin.

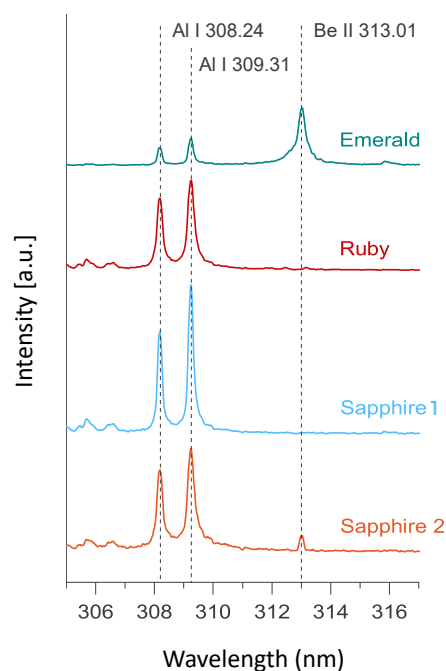


Fig.2. Detection of Be and Al in Sapphire, Ruby and Emerald

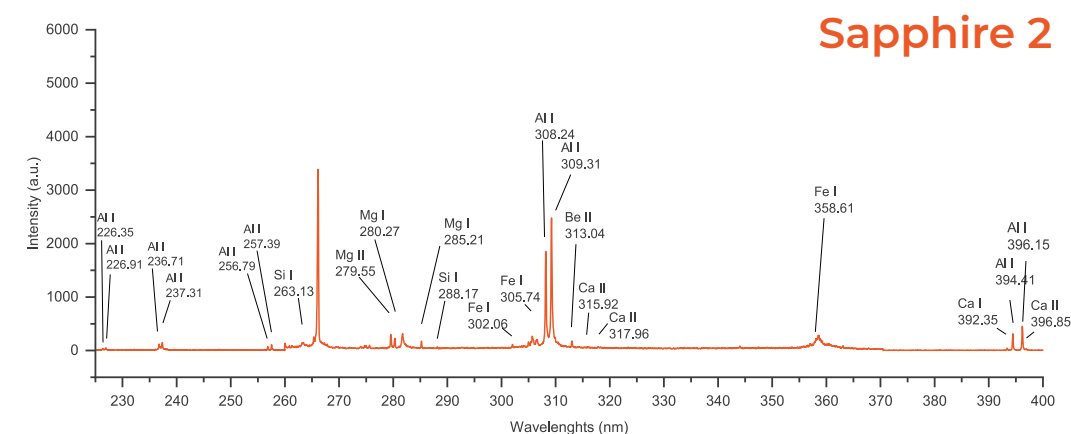
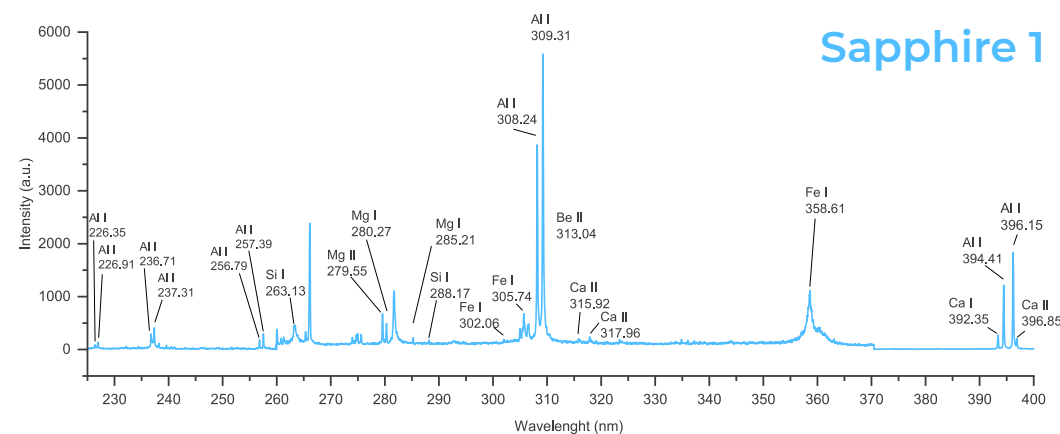
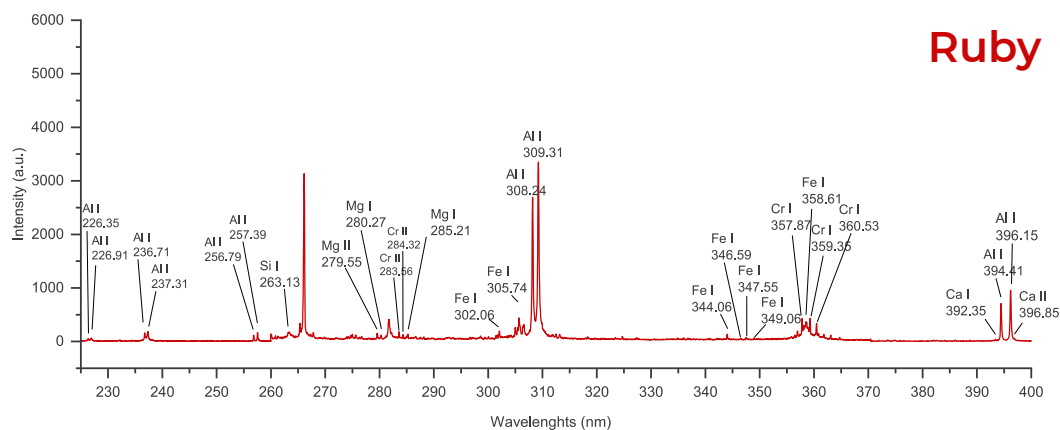
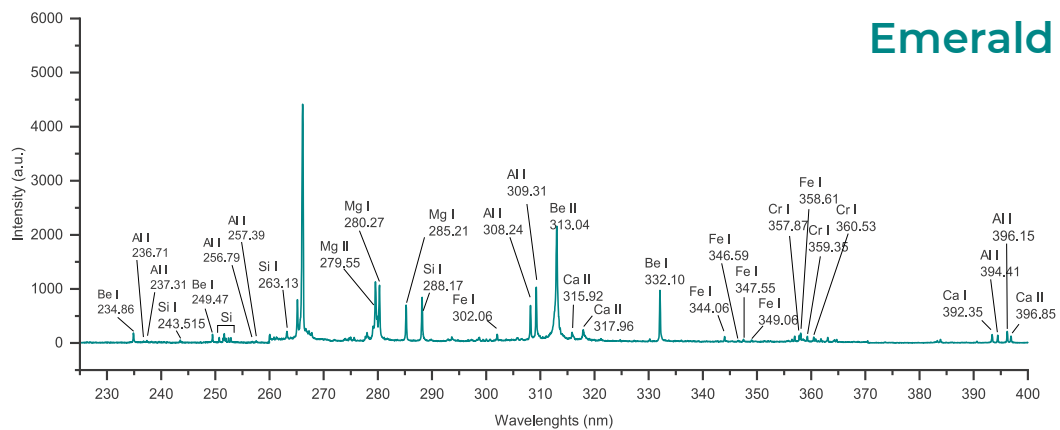


Fig.3. Emission spectra detected by FireFly in various gemstones

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