Application of irradiation in gemology

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Considerable amounts of the off-grade material with faded colours and pale patterns occur together with high-standard semiprecious stones. This decreases the gem and decorative qualities of stones and sometimes precludes their use for such purposes. The colour, contrast range of pattern, and brightness of different minerals and aggregates can be changed by gamma-irradiation combined with physical and chemical treatment of the original samples. A number of methods to change or intensify the colour have been developed; these processes are called ennobling.

As for transparent crystals, gamma-irradiation permits the ennobling of diamonds (change of grey colour to blue), corundum (change light-yellow colour to dark-blue), spinel (the colour of mineral intensifies from pale rose to dark crimson), topaz can be coloured blue (the reactor-induced irradiation), spodumene (after gamma-irradiation becomes lilac, blue-green or green), danburite (wine-yellow, light-brown colour after gamma-irradiation), scapolite can be ennobled by the combination of irradiation and annealing (blue and violet colours being obtained), nephrite (treatment in reducing atmosphere, appearance of green colour instead of yellow-brown), and prehnite (change of dirty-green colour to green).

A combination of the methods of technological modification of colour permits increasing of the yield of high standard raw materials for the jewellery industry. The use of a combination of methods is particularly efficient. They are: physical (irradiation) with thermal treatment in furnaces or autoclaves in combination with colouring by chemical reaction within the material (chalcedony) and surface coloration by organic dyes.