Diffraction gratings have a history of more than 200 years that dates back to their discovery in 1785 by the American astronomer David Rittenhouse. He noticed that light seeping through a silk handkerchief formed the same colors as a rainbow and made a grating by wrapping hair around two parallel clock screws. At that time, however, his discovery was not recognized in the world. This phenomenon was rediscovered by Fraunhofer in 1819. Fraunhofer’s first grating consisted of fine wire wrapped around two parallel screws. He also used a diamond tool to make a reflective grating with 9,600 grooves across a width of 12 mm and derived the grating equations.

In 1852 Rowland constructed a ruling engine for production of diffraction gratings which could make 14,000 grooves per inch. Most of the gratings around this time were made by ruling grooves directly into metallic mirrors.

Unfortunately the ruling engines of that time made large mechanical errors, until 1915, when Michelson came up with the idea of using light interference to control the positioning of grating grooves. Based on this technology, gratings became commercially available.

In 1955, based on Harrison’s developments [1], improvements in ruling engines made it possible to control the shape of the grooves, and concentrate most of the energy in lower orders of diffracted light. This type of grating is called a “blazed grating” and today is one of the most commonly used types.

The last half-century saw many attempts to make gratings by recording interference patterns of coherent light onto light sensitive material and finally the production of this type of grating became possible with the appearance of the argon ion laser and the high-resolution photosist. Since Rudolph and Schmahl’s creation of the first grating of this type in 1967, this field has seen remarkable progress. Because of similarities with holography, this type of grating is called a “holographic grating.”

Finally in 1976, Aoyagi, Namba, et al succeeded in changing the profile of grooves from sinusoidal to sawtooth by etching diagonally with an ion beam [2]. This made it possible to create blazed holographic gratings with any blaze angle, and such gratings are now used extensively in spectrometers.

Shimadzu has optimized the quality of the edges for the angle of reflection in the sawtooth pattern. This LO-RAY-LIGH® principle is a patented development that produces an outstanding grating quality. Until now, the generally accepted rule was: the more lines to a grating, the sharper the spectral image. With the LO-RAY-LIGH® grating technology, this rule has changed. The production process of the grating results in a high grating image precision which also yields a spectral resolution sharpness rendering better characteristics when compared to a conventional grating. The objective in the development of these gratings was a significant reduction in stray light.

For the qualification of a grating, the intensity of the first-order light is plotted against delta (nm). From figure 4 it becomes evident that the LO-RAY-LIGH® grating produces first-order light much more sharply and with less stray light over the entire range. In the diagram, a grating with 1,200 grooves/mm was compared with a blaze wavelength of 250 nm.