

CHAPTER 3

EXPERIMENTAL

3.1 Materials

Ruby and blue sapphire for this experiment

We can consider four independent criteria for evaluation of ruby and blue sapphire, namely color, cutting, clarity and carat as practiced by many leading gem companies in Thailand.

1) Color: The color criterion can be further divided into three factors, attractive color, brilliance and transparency.

2) Cutting: There are several different forms of cutting, such as step cut, brilliant cut, mixed cut of these two, and so on, but gemstone samples should be cut in the form of the mixed cut. The shape should be always in the form of oval.

3) Clarity: It is likely that gems are composed of various inclusions, and clarity is used to indicate how the gems are pure without inclusions. In the present experiment we use mostly the gems without inclusions to assure the best clarity. In selecting the samples for the experiment the magnification method was used to locate inclusions by companies which provided the gems to us.

4) Carat weight: Weight is also important in ruby and blue sapphire and it is considered that they should weigh more than 0.5 carats to be good gems. In the present experiment we employed gems of weight between 0.25 and 0.85 carats.⁽²⁵⁾

We used 115 samples of rubies and 65 samples of blue sapphires to evaluate their color. They were provided from different companies and the color codes used by these companies and numbers of the gems are given in Table 3-1.

Table 3-1 Lists of ruby and blue sapphire employed in the experiment

Types of Corundum	Color Code	Number of Samples	Company Name
Ruby	CRA - CRF	30	Beauty Gems Co., Ltd
	CSGA - CSGF	30	C. Siamese Gems Export Co., Ltd
	PGRA - RGRF	30	Paragon Precious stones Co., Ltd
	RSWDA - RSWDE	25	SWD Import & Export Co., Ltd
Blue Sapphire	CSA - CSF	30	Beauty Gems Co., Ltd
	PMSA - PMSB	10	Primeir Gems Trading Co., Ltd
	BSWDA - BSWDE	25	SWD Import & Export Co., Ltd

In these companies the gemstones are graded A through F as a color code representing dark, deep, vivid, strong, purplish and pinkish for red gemstones, and dark, deep, vivid, strong, purplish and greenish for blue sapphires. These letters appear at the end of each color code in the table. Letters preceding the grade are provided by companies to mean cutting ruby by CR and cutting sapphire by CS, for examples, in the case of Beauty Gems Co., Ltd.

3.2 Apparatus

Evaluation of color of gemstones was carried out in the viewing box called "Judge II" manufactured by the Macbeth Division of Kollmorgen Instruments Corp. It had the size of 50.8 cm height, 60.9 cm width and 50.8 cm depth, and was illuminated

by fluorescent lamps with the color temperature of about 6,500 K from the ceiling and light for the range of 300 to 830 nm. The entire surface of the box was painted at the Munsell Value of N7 and this reduced color contrast between the gemstones and the background. A glossy edition of the Munsell book of color was used to find out the color of gemstone by color matching. The sheets of hue 2.5R, 5R, 7.5R, 6.25RP, 7.5RP, 8.75RP, 10RP were used for red rubies and the sheets of hue 5PB and 7.5PB were used for blue sapphires. Some color chips were taken out from these sheets to be placed on the floor of the viewing box. The Leveridge Gauge was used to measure the size and shape of gemstones.

3.3 Observers

Four observers participated in the experiment; Ms. Somledee Sakaravate, Ms. Thitimtharee Pavaro, Mr. Sutad Singbomrung, Mr. Lela wattanasute and Ms. Pannapa Poatanom. All but the author were gemmologists coming from the Gemological Testing Laboratory. They are all normal for color vision and their age was below 29 years old.

3.4 Procedures

3.4.1 Measurement of size

As the first step of the experiment, the length, width and height of all the gemstones were measured by the Liveridge gauge. Then their shapes were determined by the visual inspection.

3.4.2 Specification of gemstones color by the Munsell notation.

There were generally observed more than one color on a face-up, but a single color was selected to characterize the color of the face-up of the gemstones as a whole. To define this single color the subjects were asked to pick up the overall color of the

gemstone excluding colors caused by surface reflection, dispersion and windowing. Tiny dark portions and black portions were also neglected in judging the overall color. A Tweezer is used to hold the gemstone sample in front of the observer. The position of the gemstone in the viewing box is shown in Figure 3-1. The light source is placed above the observer and the incident angle is 45 degrees with the table facet of the gemstone. The observer should observe directly 90 degrees to that table facet. The observation is made when the observer tilt 8-9 degrees around that position.

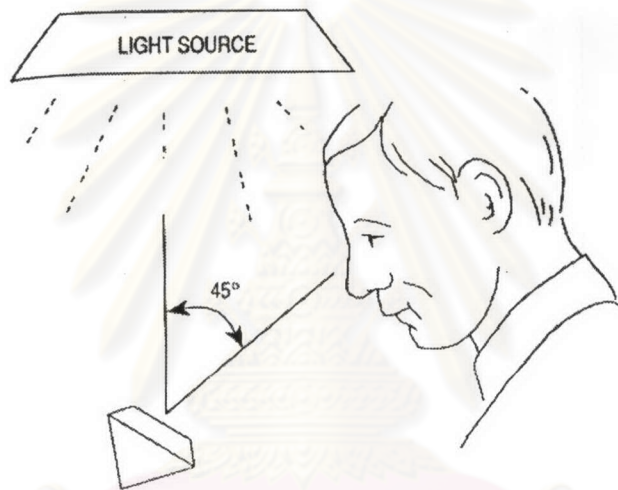


Figure 3-1 Using a standard viewing geometry, a trained grader can most readily see and evaluate a facet gemstone face-up color⁽²⁶⁾

The subject first selected about ten Munsell color chips of which colors were similar to that of the gem under investigation and put them on a holder in a column. He/she then held the gemstone by one hand and compared its color with the Munsell chips one by one in the order, and chose the three chips that he/she thought very close to the gem. Then these three chips were placed on the floor of the viewing box and the subject finally selected one chip that was closest to the gem in color. Figure 3-2 shows the arrangement of the experiment.

3.4.3 The Munsell notations were transferred to the CIELUV and CIELAB color systems. The most saturation of the ruby and blue sapphire was considered in the CIELUV color system by determining the distance between of the gemstone colorimetry coordinates and light source coordinates, more saturated the distance should be large. In term of the difference color should be considered in the CIELAB color system.



Figure 3-2 Color matching between a gemstone and a Munsell color chip

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย