An Application of Charge-Coupled Device (CCD) Tomography System for Gemological Industry - A Review

Fatinah Mohd Rahalim, Juliza Jamaludin, Syarfa Najihah Raisin, Wan Zakiah Wan Ismail, Irneza Ismail, Ruzairi Abdul Rahim, and Yasmin Abdul Wahab

Abstract Charge-Coupled Device (CCD) is a semiconductor chip with a light-sensitive sensor. The CCD has been used in many fields of engineering, including astronomy, medical sciences and processing. CCD is capable to detect light sources and convert this analogue signal into electrical signal. CCD is an integrated circuit that contains a large number of small photo elements with high sensitivity to light energy. The main focus of this research paper is on the review of CCD basic operating principle and construction, CCD characteristic, and the application of CCD in tomography system. The potential use of CCD in the gemological industry is also highlighted in this paper. Gemology is one of the important industries that considered profitable and crucial that deals with precious stones. This industry is in need of standardized grading valuation of gemstones as the current technique is prone to errors. An approach to the standardized grading technique is proposed where CCD tomography is used to detect and analyze the light distribution characteristic in ruby stones.

Keywords Charge-Coupled Device (CCD) · Gemology · Light distribution · Ruby · Tomography

1 Introduction

Since the 1980s, Charge-Coupled Devices (CCDs) have been the most widely used high-performance imaging detector in almost all scientific and industrial imaging

F. M. Rahalim · J. Jamaludin (✉) · S. N. Raisin · W. Z. W. Ismail · I. Ismail
Faculty of Engineering and Built Environment, Universiti Sains Islam Malaysia (USIM), 71800 Nilai, Negeri Sembilan, Malaysia
e-mail: juliza@usim.edu.my

R. A. Rahim
School of Electrical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, UTM Johor Bahru, 81310 Johor, Malaysia

Y. A. Wahab
Faculty of Electrical and Electronics Engineering Technology, Universiti Malaysia Pahang, Pekan Campus, 26600 Pekan, Pahang, Malaysia

I. M. Khairuddin et al. (eds.), *Enabling Industry 4.0 through Advances in Mechatronics*, Lecture Notes in Electrical Engineering 900, https://doi.org/10.1007/978-981-19-2095-0_4