

論文の内容の要旨  
Analysis on Light Transmission Characteristics  
of Multi-Metal-Layer for CMOS Image Sensors  
(CMOS イメージセンサのための多層配線層における光透過特性解析)

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This thesis focuses on analysis of light transmission characteristics by calculation, simulation, and measurement. We address new analysis method for light transmission through multi-metal-layer.

We also propose the color filter using the interconnect layer including the metal pieces and wire-grid polarizer.

Chapter 2 proposes a simple analysis method using the transfer matrix for light transmission rate through multi-metal-layer. It makes the calculation simple and is verified by the commercial simulator.

Chapter 3 presents the light transmission characteristics through multi-metal-layer. It is analyzed by the proposed transfer matrix in the chapter 2. The light transmission rate is calculated for standard CMOS 1.2um to 22nm. The wavelength dependency is varied with CMOS process's downscaling from the results.

Chapter 4 presents the modulation of dielectric constant in the interconnect layer. We have presented that the inserting the metallic particles in the dielectric substance causes the modulation of dielectric constant of the layer. We develop the modulation concept by near-field optical microscopy and capacitance model of macroscopic aspect.

Chapter 5 presents the modulation of spectral dependence of metal layer. Photodiodes having the metallic square in the dielectric layer is simulated the light intensity transmitted and absorbed in silicon area by optical simulation. We also design the photodiodes having the metallic square in the dielectric interconnect layer by a CMOS 65nm process technology. The modulation of spectral dependency is realized by inserting the metallic squares.

Chapter 6 shows the effect of wire-grid polarizer in the interconnect layer. The light

transmission characteristics by the incident polarized light of wire-grid polarizer is analyzed by optical simulator. We also discuss the process monitoring with the variation of wire-grid polarizer's configuration. The inserting wire-grid polarizer makes the modulation of wavelength dependency. It realizes the wire-grid polarizer is useful for the color filter.