

**INVESTIGATIONS OF ELECTROPHOTOGRAPHIC
AND PHOTO-ELECTRET CHARACTERISTICS
IN SINGLE, MIXED AND MULTI-LAYER
PIGMENT-RESIN SYSTEMS**

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To mon chère poupée

CERTIFICATE

I am satisfied that the thesis entitled
'Investigations of Electrophotographic and Photo-electret
Characteristics in Single, Mixed and Multi-Layer Pigment-
resin Systems' submitted by Navneet is worthy of con-
sideration for the award of the degree of DOCTOR OF
PHILOSOPHY and is a record of the original bonafide
research work carried out by him under my guidance and
supervision and that the results contained in it have
not been submitted in part or full to any other
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ABSTRACT

This thesis concerns with the characterization of various single, mixed and multilayer pigment-resin systems for their application in xerography and PIP electrophotography. HgS single layer, HgS/Cd(S,Se):Cu and PbO/Cd(S,Se):Cu mixed layers and PVC_Z/HgS and Michler's ketone/Cd(S,Se):Cu double layers were the different pigment-resin systems investigated. The binder resins used were - poly (acrylonitrile-butadiene-styrene), polystyrene, ethyl cellulose and poly (vinyl acetate).

A study of photo-conducting properties of the two mixed systems - HgS/Cd(S,Se):Cu and PbO/Cd(S,Se):Cu was carried out in order to have a better understanding of charge transport phenomenon in the bulk of the material. Dark current and photo-induced current dependence upon the field across the sample, were studied. Different compositions of the two compounds in both the systems were examined. The 40:60 ratio of HgS/Cd(S,Se):Cu shows an enhanced $I_{\text{photo}}/I_{\text{dark}}$ value ($= 10^5$). The photo-current dependence on the intensity of illumination shows a continuous distribution of trapping levels in the 40:60 ratio of HgS/Cd(S,Se):Cu. At higher light intensities, a supralinear behaviour was observed. Activation energies were calculated from dark and photocurrent dependence on temperature. Response time and drift mobility dependence upon temperature shows an increase in carrier mobilities at elevated temperatures. Electrons and holes were found

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equally probable for conduction in all the systems at room temperature.

Electrophotographic studies consisted of dark and photo-induced discharge characteristics, contrast potential, dynamic range, spectral sensitivity and absorption spectra for different systems. The HgS layer gives a maximum acceptance potential with ABS binder among all the binders used. It was observed that the mixed and double layer systems have enhanced electrophotographic characteristics over the single layer systems. Photo-electret studies were carried out to assess the suitability of two mixed systems for PIP electrophotography. The 40:60 ratio of HgS/Cd(S,Se):Cu and 60:40 ratio of PbO/Cd(S,Se):Cu were observed to show good photo-electret charge. These composite systems are, however, unsuitable for PIP electrophotography as their charge retention properties were poor, indicating an absence of deep traps in the composite materials.

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