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A Fluorescent Backlighting System for Observing High Pressure, Low Temperature Phase Equilibria Phenomena

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An electro-optical system for observing high pressure, low temperature phase equilibria phenomena has been tested at 25 $MN \cdot m^{-2}$ and liquid nitrogen temperatures. The system consists of a uv source exciting an intracell fluorescent pigment which illuminates the cell interior. The cell is observed by a closed circuit television camera and monitor, and a permanent record is made with a video tape recorder.

INTRODUCTION

SEVERAL interesting critical phenomena have been observed in our low temperature phase equilibria laboratory without a permanent record being made. To prevent this happening in the future, a system consisting of a closed circuit television (CCTV) camera, monitor, and video tape recorder (VTR) was purchased.

Two problems prevented the effective use of the system as purchased. The first was the absence of an adequate means of illuminating the cell interior. The second was an inadequate image size of the cell interior and its contents on the monitor because only a 1:1 image-to-object size ratio was achieveable. This provided only a 1×4 cm image of the cell window on the CCTV monitor.

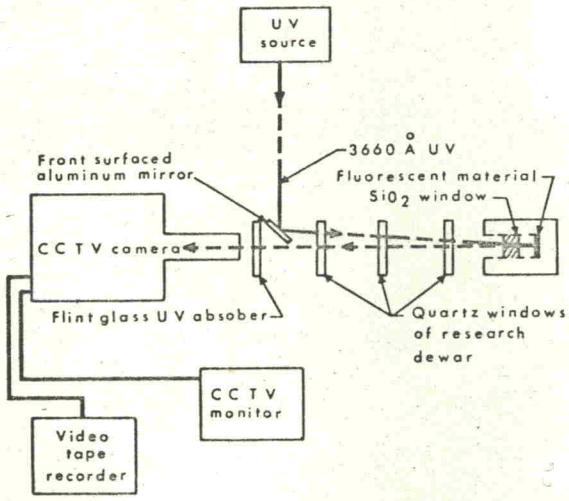

FIG. 1. Electro-optical system (schematic).

THE SYSTEM

The system for observing high pressure, low temperature phase equilibria phenomena consists of the following major components: a Sylvania model 600 CCTV camera[1] equipped with a Sylvania 25 mm, $f/1.9$ lens, and a Meyer Trioplan 90 mm, $f/3$ lens; a Sylvania model VMR 14 CCTV monitor with a 30.5 cm diagonal screen; a Sony Videocorder, model SV 300; and a blacklight Eastern Spectroline model B-100 uv source equipped with a spot bulb producing a 6.5° beam.

The schematic diagram of the system is shown in Fig. 1. From the uv source, a filtered beam of 3660 Å light is reflected from a front surfaced aluminum mirror into the cell interior. The rear of the cell chamber is coated with a fluorescent pigment, supplied by United States Radium Corporation, color No. 2205, which is excited by the 3660 Å ultraviolet and emits in the blue region with its emission peak at approximately 4500 Å. This peak corresponds to the spectral sensitivity peak of the Sylvania 1319 (RCA 7038) vidicon tube in the CCTV camera, thereby providing maximum image brightness.

The emitting fluorescent pigment provides a backlighting illumination that yields excellent image contrast of the vapor–liquid meniscus. The emission of the fluorescent pigment and the image of the meniscus then pass through fused silica cell window, the quartz Dewar windows, and a piece of flint glass, which absorbs any stray uv light, and into the lens–CCTV camera complex.

The Meyer Trioplan 90 mm $f/3$ lens is used in combination with a set of 1–80 mm variable lens extension rings. This feature provides the desired image magnification up to approximately 30 times, permitting as little as one fourth