Proceedings of the Iowa Academy of Science

Volume 37 | Annual Issue Article 71

1930

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THE CHANGE OF PHASE ON REFLECTION OF LIGHT FROM THE SILVERED INTERFACES OF AN ETALON

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In making wavelength determinations to the accuracy of one-thousandth of an Angstrom with a Fabry and Perot Etalon it is necessary to know the wavelength of the line to one-tenth of a Angstrom, the thickness of the etalon and the change of phase on reflection of the light from the interfaces of the etalon. This change of phase is a function of the wavelength, varies with the metal, the way it is deposited and with the surface upon which it is deposited. A separate determination must be made for each etalon. This change of phase is usually expressed as a correction applied to the wave length determination.

The results reported here were determined for a silver film cathodically deposited on glass etalon plates made by Adam Hilger, London, for Parsons College. The quartz separators used were those belonging to the Physics Department of the State University of Iowa.

The method used in determining the thickness of the etalon and the phase change is that described by Burns and Meggers.[1] The determination of thickness is given in Table I.

Table I—Determination of Thickness of Etalon-E_1

λ	ε_1 Obs. Expert'ly	$N + \varepsilon_2$ Computed $2t/\lambda$	$\varepsilon_1 - \varepsilon_2$
5852.488A	.819	57056.819	.000
5944.834	.509	56170.508	+.001
6334.428	.781	52715.785	—.004
6532.883	.393	51114.393	.000
6678.276	.576	50001.579	—.003
	2t = 33.392435 m.m.		
	Data for ε_2		
5852.488A	.623	34141.623	.000
5944.834	.266	33611.273	—.007
6143.062	.698	32526.684	—.014
6334.428	.048	31544.038	+.010
6506.528	.692	30709.687	.005
	2t = 19.981344 m.m.		
	Data for ε_3		
5852.488A	.664	22822.659	.005
5944.834	.140	22468.136	+.004
6143.062	.117	21743.121	—.004
6334.428	.247	21086.251	+.004
6532.883	.697	20445.696	+.001
	2t = 13.356934 m.m.		

The wavelengths' λ, used are secondary standards from the neon

1 Burns and Meggers, Wave-lengths of Iron Standards, Bull. Bur. Stand. 12, page 179, (1915).

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spectrum. N is the order or the integer number of wavelengths in twice the thickness, ε_1 is the observed and ε_2 is the computed fractional order. The accuracy of the determination may be judged by the smallness of the figures in the column ε_1-ε_2.

For the determination of phase change, three lines were used in the near ultra violet of the neon spectrum.

Table II—Determination of Phase Change

E_1	E_2	Wave Lengths—Angstroms	
		E_3	From Critical Tables
3447.702	3447.703	3447.701	3447.703
3472.571	3472.572	3472.572	3472.573
3417.899	3417.903	3417.906	3417.906

The wavelength determined, before applying the phase change, would ordinarily be different for each of the etalon thickness used. The results here obtained, however, show that the wavelength for three of the lines is the same for the three etalons and furthermore it is in agreement with wavelength determined by other observers and reported in the International Critical tables. This shows that the phase change is nearly zero and much smaller than that reported by other observers. It is, however, in qualitative agreement with the results of Fabry and Buisson,[2] who report the phase change to be least for silver film cathodically deposited on glass than for silver film chemically or cathodically deposited on quartz.

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2 Fabry and Buisson, Reflexion sur les couches metallique Minces, Journ. de Phys. 7, p. 417 (1908).