Derivation of a four-parameter density formula of the photographic characteristic curve

Ewald Gerth

Academy of Sciences of the GDR, Central Institute of Astrophysics, Potsdam
Dedicated in his memory to Klaus Kröber [1])

Abstract

A simple four-parameter formula of the characteristic curve is derived on the basis of the theory of the photographic process, making use of special approximations that allow for elementary integration. The four parameters correspond to the saturation density, the opacity density, the step order of the development centers, and the sensitivity – representing the main quantities of the characteristic curve. The formula may easily be inverted and it is suited for interpolation of the characteristic curve, being therefore appropriate for computerized sensitometric evaluation.

Zusammenfassung

Unter Anwendung spezieller Näherungen, die elementare Integrationen erlauben, wird eine einfache, vier-parametrige Formel für die Schwärzungskurve auf der Basis der Theorie des photographischen Prozesses hergeleitet. Die vier Parameter entsprechen der Sättigungsschwärzung, der Opazität der Schicht bei der Belichtung, der Reaktionsordnung der Entwicklungskeime und der Empfindlichkeit, womit die hauptsächlichen Größen der Schwärzungsfunktion dargestellt werden können. Die Formel ist leicht invertierbar und eignet sich zur Interpolation der Schwärzungskurve, womit sie in einer rechnergestützten sensitometrischen Auswertung eingesetzt werden kann.

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[1]) Dipl.-Ing. K. Kröber died on Dec. 9th, 1988 at the age of 83. He was one of the leading engineers in the field of film techniques of the nationally owned movie-producing enterprise DEFA, engaged especially in the development of measuring and controlling methods for deriving quality standards of raw film materials. The author is deeply indebted to him for a long and true friendship as well as for a fruitful scientific cooperation, giving among other things the incentive to investigate the properties of the photographic emulsion represented by the characteristic curve.