

# Silver Physical Developers for the Visualization of Latent Prints on Paper

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**REFERENCE:** Cantu AA: Silver physical developers for the visualization of latent prints on paper; *Forensic Sci Rev* 13:29; 2000.

**ABSTRACT:** Silver physical developers consist of silver ions and a reducing (developing) agent. They were formulated for developing latent images on photosensitive materials such as photographic emulsions. The mechanism of how the latent image nuclei catalyze the reduction of silver ions by a reducing agent to form black colloidal silver particles has been extensively studied. These developers also happen to visualize latent prints on porous surfaces such as paper. Several hypotheses exist that identify the components in latent print residue that trigger physical development; also several hypotheses exist that explain why such developers work better on porous rather than non-porous surfaces. The more common of these developers use ferrous ions (from a ferrous/ferric redox couple) to reduce silver ions on the surface of latent print residue.

Five such silver physical developers are compared through their cell potential  $\Delta E$  (and the corresponding reaction quotient  $Q$ ). Each developer is represented by a point on a line given by  $R = QC$  where  $R = [\text{Fe}^{3+}]/[\text{Fe}^{2+}]$  and  $C = [\text{Ag}^+]$  and has a point on the line given by  $R_{\text{eq}} = Q_{\text{eq}} C_{\text{eq}}$  where  $Q_{\text{eq}} = K = 1.22$  corresponds  $\Delta E = 0$ . The quantity  $C - C_{\text{eq}}$  is the maximum amount of silver it can deposit. The development rate of a silver physical developer is directly related to its cell potential  $\Delta E$ , the temperature, the maximum amount of silver that it can deposit, and the magnitude of  $[\text{Fe}^{2+}]/[\text{Ag}^+]$ . The contrast of a physically developed latent print (on light or dark surfaces) can be enhanced by optical, image enhancement, scanning electron, x-ray, and chemical methods. The latter includes bleaching or intensifying methods, fluorescent dye toning, and radioactive sulfur toning.

**KEY WORDS:** Fingerprint, forensic science, gold colloids, multimetal deposition, physical developer, silver colloids, visualization.

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