

"Carbon on Cotton" for Best Image Stability

www.PaulRoark.com

Carbon Pigment Inks

Where image permanence is an important factor, I favor 100% carbon pigments for a number of reasons. The carbon pigment is the most lightfast pigment we have, by far. See the chart, below, which summarizes information from fade tests by Aardenburg-Imaging:¹

Delta-e at 60 Mlux-hrs Light Exposure

	Average	50% test patch
Eboni 3-MK, PA 205, Print Shield spray	0.2	0.2
Eboni 3-MK, H. Photo Rag (HPR)	0.3	0.2
Cone Carbon Sepia, Museum K, HPR	0.4	0.2
Epson ABW, HPR	1.0	1.6
HP Vivera, HPR, neutral only	1.1	1.4
Cone Neutral K6, HPR	2.2	2.9

100% carbon inksets provide a baseline against which to measure and compare others.²

While all carbon pigments for inkjets are warm, MIS Associates' "Eboni" MK is the most neutral carbon I know of. As such, MIS Eboni and dilutions of it form the core of the matte paper printing systems I use. For more information on Eboni print tones, which vary significantly with different paper types, [click here](#). When framed under glass or acrylic, these matte carbon pigment prints can look very much like my darkroom silver prints -- but better in most cases.

Whenever color inks are part of the B&W mix, artifacts such as metamerism, faster fade, and color shifting from differential fading of the color inks compromise the image.

High gamut color inks are harder to profile and more sensitive to paper and ink batch variations. With a single carbon pigment type used throughout the density range, profiles are more portable among papers. Simple re-linearization is often all that is needed for a new paper.

The major ink sellers, of course, are well aware of the stable nature of carbon. Carbon or substantially carbon mixes are used in the black positions and form much of the neutral core of

¹ <http://www.aardenburg-imaging.com/>

² For more information on carbon printing stability, [click here](#).

the OEM color inksets, though it appears the Epson K3 neutral core may contain less than 50% carbon.

Glossy compatible carbon pigments tend to be smaller particles for smoothness. It appears that the smaller the carbon particles are, the warmer the image tone will be, particularly on coated papers. Thus, for example, the 100% carbon MIS uses in its glossy compatible inksets is significantly warmer than MIS Eboni MK. Making a 100% carbon, neutral glossy inkset has not been possible. To make a neutral gloss B&W inkset requires significant amounts of colors to be added. This is one of many reasons I prefer matte paper for fine art, neutral tone B&W.

My current preferred inkset approaches use MIS Eboni-6 and variants of it for relatively neutral B&W printing on matte paper and MIS glossy carbon inks where glossy printing is required. This glossy carbon can print a sepia tone on glossy paper. The warm (sepia) carbon inks are featured in the Elverhoj museum historic photo display for the Solvang, California centennial celebration.

While I favored 100% carbon printing for the most lightfast and stable prints, the best of the blended color + carbon systems are performing reasonably well in [Aardenburg Imaging & Archives](#) fade testing, which is the best and most detailed available to us. For most uses, the top quality blended ink approaches will be fine. Still, however, one can expect density and color changes (as measured, for example, by the midtone "delta-e" values) of the carbon + color B&W prints to be from several to many times those of prints made with 100% carbon pigments.

For B&W, carbon is the benchmark for image permanence. For B&W purists, it combines the best, most stable image with very low costs.

Cotton Paper

While carbon pigments are very stable, the image-forming substance is not the only component of a print that must hold up well. The substrate (usually paper) must also not yellow or otherwise deteriorate. In this regard, the use of acid-free, preferably cotton, papers that contain no optical brightening agents ("OBAs") is recommended. There are optical brightening agents in most inkjet papers. These are dyes that make a paper appear to be brighter (actually bluer), but they fade relatively quickly. A carbon image on brightened paper will not fade significantly, but the overall image tone will warm as the paper's OBAs fade. The brightened papers are the most popular and can look very nice, but be aware that for long term display they will warm.

The counter-point to the OBA fading/warming issue is that natural papers bleach with exposure. A low load of OBAs in a paper might cause the paper to change tone no more than this bleaching. They might even offset each other to some extent. Additionally, the warming of a print with age to its natural paper tone is not in the same league as the greening of a print with differential color ink fade. As the OBAs fade, there is simply a straight line tone change to the natural and bleached paper tone. OBAs do not appear to have any impact on the image permanence as such. I, frankly, often use papers with OBAs.

At some point -- and we may be there with the 100% carbon pigment inksets -- the paper becomes the limiting factor in image longevity. In this regard, Arches uncoated watercolor paper may be of particular interest. It has stood the test of time, having been used by artists for about 500 years. There is no coating to flake off or crack. It can even be washed or rinsed to some extent. While there are other un-coated watercolor or art papers, Arches Hot and Cold press have the deepest blacks (highest dmax) by a significant margin in my testing. On the other hand, Arches is harder to print on, the dynamic range is less, and the images are not as smooth. Moreover, we have no good fade tests that show whether images on it are as permanent as the coated inkjet papers. In fact, tentative results suggest the best coated matte cotton papers make the most lightfast images, and that is what I favor for most of my images. However, Arches, as well as other un-coated art papers, can be serious alternatives that collectors and artists may want to consider.

Note that the silver prints of the past were neither cotton nor, due to the use of acidic processing chemicals, could they be buffered against acid attack. I have observed yellowing of my silver prints due to airborne acids.

"Carbon on cotton" (particularly buffered and with no OBAs) defines, in my view, the paradigm for archival B&W printing.