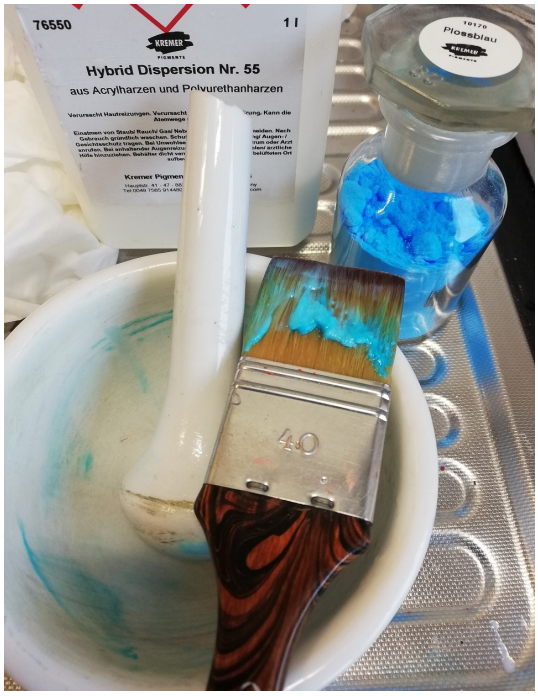
Copper Based Pigments in Acrylic Dispersions

Copper based pigments like Verdigris or Ploss Blue can react with various binding media. It is well known that these pigments are not stable in oil and can cause a green or brown discoloration of the paint. Their suitability may also be limited in other traditional binding media such as tempera, watercolour or animal glue. We have not yet had sufficient knowledge of their behaviour with modern binders such as acrylic or other synthetic resin dispersions. Since artists who work with these materials like the brilliant blue or green shades of these copper based pigments we have tested some of them in December 2022 in acrylic dispersions from the Kremer assortment. They have been monitored for a period of one year in order to better classify their stability and reactiveness.

The results vary quite a lot. While some of the pigments can be made into an acrylic paint more or less successfully it may happen that a pigment shows such a strong reaction with the dispersion that it is simply impossible to use it as a paint. The paint can thicken and become smeary or lumpy. In the best case the paint can then still be spread on a surface, in some cases it becomes utterly unusable. In addition, it can happen that a pigment can be used in combination with a medium, but over time, discoloration can occur. We have observed discolorations such as more or less strong yellowing of the paint as well as fading of the pigment.

In total, four copper based pigments were tested in nine different binding media. Beside the relatively stable synthetic Malachite (#44400) we tested #10170 Ploss Blue and #44450 Verdigris, both known for their instability. Additionally, we tested #45364 Copper Blue. The pigments were used in all acrylic and polyurethane dispersions that are suitable for acrylic paints as well as in #75085 Acrylic Gel K 85. The detailed results are described on the following pages.

In summary it can be said that copper based pigments can only be recommended in acrylics to a limited extent. In any case it is advisable to carry out tests regarding the stability oft he pigment in the binder used. Because of the extreme yellowing tendency that the verdigris paints showed in our tests, we advise against using this pigment in acrylics. The experiments with this pigment indicate that it may not necessarily be the pigment that has changed, but rather that it caused a discoloration of the binding medium.



#10170 Ploss Blue reacts with #76550 Hybrid Dispersion No. 55 and forms a gel-like, smeary paint that clumps in the brush and is difficult to spread.

#44450 Verdigris and #75305 Dispersion K 19 form a lumpy mass that is unusable.

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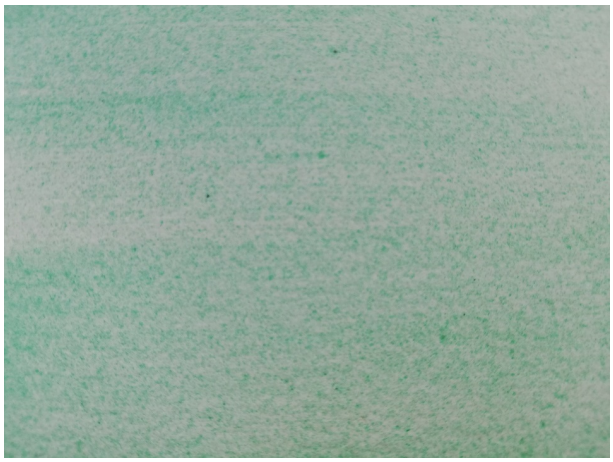
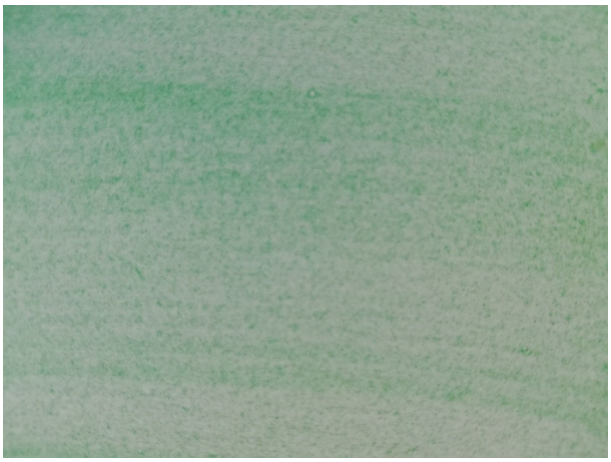
#44400 Malachite Synthetic

Malachite is a basic copper carbonate that is known to discolour in oil, but is relatively stable in other binding media. It was included in these tests for comparison with other, more reactive copper based pigments. In contrast to most of them, Malachite can be used in all of the binding media. Only in combination with #76550 Hybrid Dispersion No. 55 the paint gets a little bit lumpy. The paintouts of Malachite showed the least colour change. Nevertheless, all paintouts show a slight yellowing tendency.



This paintout of #44400 Malachit in #76000 Dispersion K 498 was kept in the dark.



Exposed to light for one year, the hue changes slightly into a more yellowish green.

44400 Malachite synthetic in	**Use**	**after 1 year**
75075 Dispersion K 52	workable	no visible colour change
75085 Acrylic Gel K 85	workable	the colour turns yellowish-brownish
75305 Dispersion K 19	workable	slight yellowing of the paint
75367 Dispersion K 9	workable	slight yellowing of the paint
75600 Dispersion K 500	workable	slight yellowing of the paint
76000 Dispersion K 498	workable	slight yellowing of the paint
76550 Hybrid Dispersion No. 55	lumpy, but workable	slight yellowing of the paint
76805 Polyurethane Dispersion PU 52	workable	slight yellowing of the paint
76806 Polyurethane Dispersion 61 PC	workable	slight yellowing of the paint

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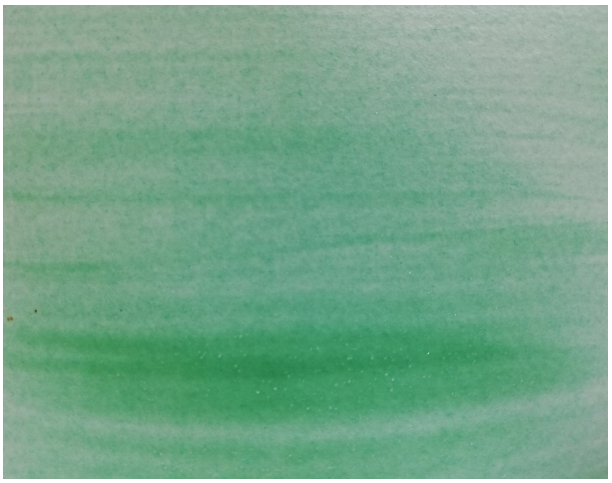
#45364 Copper Blue

Copper Blue is a copper phosphate. Similar to Manganese Violet or Cobalt Violet it can react with some binding media. Amongst all pigments used in this test series, copper blue is the most easiest to process. Paints stayed smooth, they did not thicken, get lumpy or flocculate. However, colour changes such as yellowing or fading of the paint may occur over time.

This paint sample of #45364 Copper Blue in #75085 Acrylic Gel K 85 was kept in the dark.



When exposed to light, the #45364 Copper Blue/#75085 Acryl Gel K 85 paint turns greenish.

45364 Copper Blue in	**Use**	**after 1 year**
75075 Dispersion K 52	workable	fades slightly
75085 Acrylic Gel K 85	workable	the paint turns greenish
75305 Dispersion K 19	workable	no visible colour change
75367 Dispersion K 9	workable	no visible colour change
75600 Dispersion K 500	workable	slight yellowing of the paint
76000 Dispersion K 498	workable	no visible colour change
76550 Hybrid Dispersion No. 55	workable	no visible colour change
76805 Polyurethane Dispersion PU 52	workable	no visible colour change
76806 Polyurethane Dispersion 61 PC	workable	slight fading of the paint

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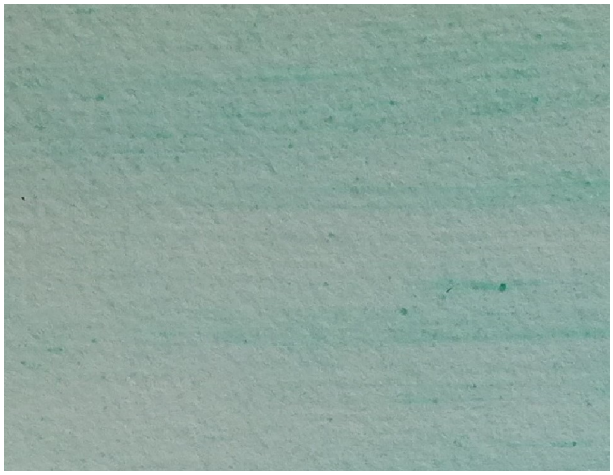
#10170 Ploss Blue

Ploss Blue is a copper calcium acetate, that can be as reactive as verdigris. This pigment was only usable in five of the tested binders, in two of them it turned out rather difficult to use. All paints showed distinct yellowing, the paints made with Dispersion K 9 and K 500 also faded.



#10170 Ploss Blue thickens in #75305 Dispersion K 19 and forms a smeary paint that is difficult to spread.

After a year the paint made with #10170 Ploss Blue has yellowed, in some cases it also faded.

10170 Ploss Blue in	**Use**	**after 1 year**
75075 Dispersion K 52	gets lumpy immediately, unworkable	-
75085 Acrylic Gel K 85	unworkable	-
75305 Dispersion K 19	thickens, difficult to use	distinct yellowing of the paint
75367 Dispersion K 9	workable	slight yellowing and fading of the paint
75600 Dispersion K 500	workable	slight yellowing and fading of the paint
76000 Dispersion K 498	workable	distinct yellowing of the paint
76550 Hybrid Dispersion No. 55	very difficult to use	distinct yellowing of the paint
76805 Polyurethane Dispersion PU 52	unworkable	-
76806 Polyurethane Dispersion 61 PC	unworkable	-

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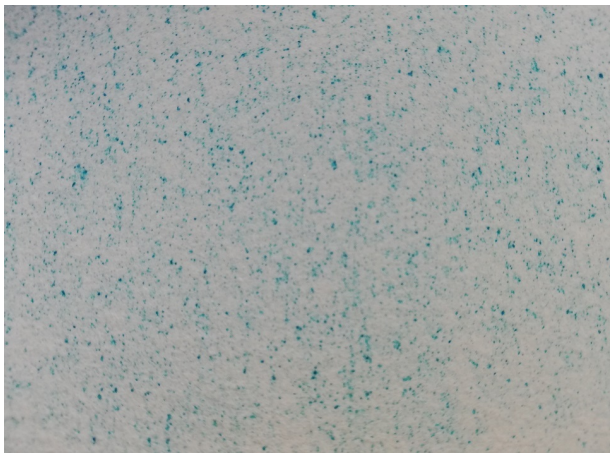
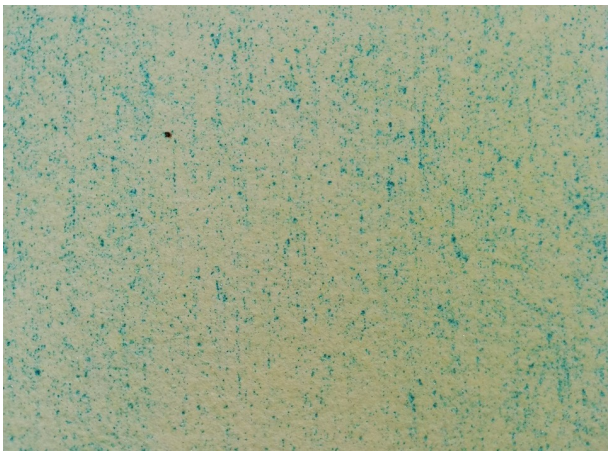
#44450 Verdigris

Verdigris is a copper acetate and has been known for its instability for centuries. The pigment can react with acrylic dispersions to a smeary or lumpy mass which can either be difficult to spread or turn utterly unusable. It can only be used in Dispersion K 52, K 9, K 500 and K 498. However, that doesn´t mean that the paint stays stable over time. In all our tests, the paint showed a very strong yellowing tendency. While the blue-green particles of the coarse pigment are still visible, it appears as if the binder has yellowed.



Of the pigments tested in this study, #44450 Verdigris, here in #75075 Dispersion K 52, is the most unstable.



All the paintouts of #44450 Verdigris show strong yellowing, even the very thin film of #75075 Dispersion K 52.

44450 Verdigris in	**Use**	**after 1 year**
75075 Dispersion K 52	workable	strong yellowing of the paint
75085 Acrylic Gel K 85	unworkable	-
75305 Dispersion K 19	unworkable	-
75367 Dispersion K 9	workable	strong yellowing of the paint
75600 Dispersion K 500	workable	strong yellowing of the paint
76000 Dispersion K 498	workable	strong yellowing of the paint
76550 Hybrid Dispersion No. 55	difficult to use	very strong yellowing of the paint
76805 Polyurethane Dispersion PU 52	difficult to use	strong yellowing of the paint
76806 Polyurethane Dispersion 61 PC	unworkable	-

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