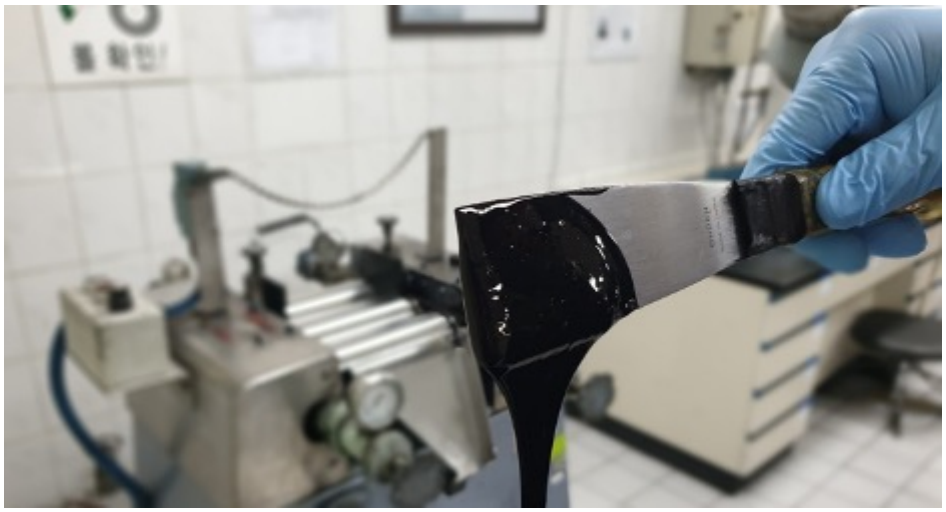
BIRLA CARBON BLOG

INSIDER KNOWLEDGE FOR ALL THINGS CARBON BLACK

6 Precautions When Designing Thermoplastic, PVC and Polyurethane Colorant Formulations

08 / 17 / 2021 by Jinil Kim



There are many ways to add color and functionality to your plastic material. Printing, coating and plating methods are used to implement color and functionality on the surface of plastics. Common methods to add color and functionality to both the interior and exterior of plastics include direct dispersion and the use of colorants. Among colorants, only color paste has a liquid form different from masterbatch or color chip, and follows similar formulation and dispersion methods to coating as shown in the table below.

• PU System	Formulation: PU resin + Pigment + Solvent + Additives Use mainly for: PU systems & PU synthetic leather
• PVC System	Formulation: Plasticizer + Pigment + Additive + Functional filler Use mainly for: Casting PVC & Calendering PVC
• Other Thermoplastic Systems	Formulation: Base resin + Pigment + Styrene monomer + Additives Use mainly for: SMC & BMC

Color paste has the advantage that it can be applied in various types of plastic and can perform in more diverse color requirements. However, in order for color paste with carbon black, to fully demonstrate these benefits, there are a few things to watch out for. Here are 6 precautions and tips you need to know as follows.

1. Color performance and dispersion

The better color performance of color paste, the less the amount of colorant used, thereby preventing side effects such as migration. Carbon black with a large surface area tends to increase jetness and tinting power, but it is necessary to select a suitable carbon black and dispersion method in consideration of the balance of dispersibility. It is also important that different batches show the same color. To resolve this problem, it is necessary to pay attention not only to the dispersion of carbon black, but also to the selection of additives that can help with long-term stability.

2. Compatibility

When selecting a raw material of color paste, it is necessary to consider compatibility between the raw materials first. It is necessary to confirm the polarity and pH of the polymer to be dispersed with carbon black, and to review the dispersing conditions. For example, when treated carbon black is dispersed in a polymer sensitive to changes in pH, the dispersion and color may be affected by phenomena such as hazing, seeding, shocking, gelling, etc. The compatibility between the color paste and the polymer which is the target of the color paste should also be considered. To this end, it is important to select a polymer, carbon black, and additives in consideration of compatibility and to determine a carbon black loading at a level that does not affect the compatibility.

3. Heat resistance

Plastic molding inevitably requires thermal energy and cases where the finished product is exposed to heat can also be considered. Carbon black itself is one of the pigments with the strongest heat resistance, but if the heat resistance of other raw materials used with carbon black in color paste is insufficient, the overall heat resistance of the color paste itself is

deteriorated. Therefore, it is necessary to select not only the carbon black in the formulation considering thermal energy, but also other raw materials in consideration of heat resistance for color paste.

4. UV resistance

For plastic products used outdoors, it is essential to consider UV resistance. To this end, it is important to use an appropriate amount of UV stabilizer or curing agent that can help to improve UV resistance. It is also important to avoid raw materials that act as photodegradation catalysts such as TiO_2. Carbon black is a representative UV absorber such that fully dispersed carbon black at the appropriate loading can improve UV resistance.

5. Migration

Bleeding is a phenomenon in which dyes or pigments come out to the plastic surface together with plasticizers or UV stabilizers, which are often used as carriers of color paste. In inorganic pigments such as carbon black, such bleeding rarely occurs, but migration occurs in which carbon black appears on the surface of plastics using carbon black color paste. The migration of carbon black can occur when carbon black loading for color paste is high or the amount of color paste used is large, but most carbon black migration is caused by undispersed carbon black. In order to decrease the migration issue due to undispersed carbon black, it is necessary to first review the change of the formulation and dispersion method. The use of more easily dispersible carbon black is an option worth considering.

6. Functionalities other than color

Conductive performance – carbon black is also one of the conductive additive materials. The conductive performance of the finished product can be determined by the resin type and formulation of raw materials, but the performance of carbon black is determined by its surface area, structure, surface chemistry, porosity, and the dispersion.

Chemical regulations – there is a movement around the world to more safely manage chemicals. These chemical regulations are being applied more strictly and faster, especially in the food contact, skin contact, semiconductor, and automotive applications. Therefore, it is necessary to first check the chemical substance regulations for color paste and the finished products. The regulations must be followed not only for carbon black, but for all raw materials used.

If you understand the needs of the market and design color pastes with suitable raw materials and mixing methods, you can reduce trial and error. Birla Carbon application experts are available to help you with this task.

I think that color paste is very similar to the formulation/dispersion of the coating. If you want to refer to the know-how of coating systems for color paste formulation, I recommend reading Dr. Richard Abbott's previous blog "Five (Less Obvious) Reasons Your Coatings Formulation Is Not Performing".

Jinil Kim

Jinil is currently Senior Manager of the Specialty Blacks application laboratory in South Korea and Technical Service, North Asia, for the plastics, inks and coatings markets. He has been working in the coatings industry since 1998 and joined Birla Carbon in 2009. He likes to communicate with customers and enjoys developing

solutions to customers' application problems. He also hopes to support the use of carbon black in a variety of applications. Jinil completed his doctoral course in electrochemistry from the Korea Polytechnic University. He received his Master of Science in industrial chemistry in Inha University and his Bachelor of Science in chemical engineering from Korea Polytechnic University.

Leave A Comment

Logged in as Birla Carbon. Log out »

Comment...

POST COMMENT

HAVE QUESTIONS? WANT NEWS, EVENTS, AND INSIGHTS IN YOUR INBOX?

CONTACT BIRLA CARBON

JOIN OUR EMAIL LIST

Birla Carbon Blog