

# ChemBrief



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## Tixogel® organoclays for printing inks

Tixogel® organoclays are crucial tools in the ink maker's formulations for today's modern presses. They are used to obtain the desired application properties that are critical to successful high-speed printing. The printing processes require the application of a scientifically determined and uniform film thickness of ink to substrate at ever increasing speeds. Without the rheological contribution of Tixogel® organoclays, this could be a difficult task.

Tixogel® organoclays ensure the required body and tack to the ink as required by the process, while working in a complementary way with the other formulation ingredients that also influence the rheology of the finished ink. The organoclays provide the ink formulator increased latitude in selecting the level of other additives necessary for trouble free production runs.

Tixogel® organoclays provide rheology control by the interaction of the individual clay platelets dispersed in the ink interacting with one another through a network organized in an edge-to-edge fashion. The thickening mechanism does not contribute to a high elastic component of viscosity. Therefore, ink formulated with Tixogel® organoclays typically exhibit low or no misting on press.

The selection of the type and amount of Tixogel® organoclay must take into account the type of ink (News ink, Heatset, Gravure), and the manufacturing process (Cowles blade, three roll mills, shot mills). Tixogel® VP, and MP, externally activated, should be used in inks manufactured under high shear (shot mills, three roll mills). Where feasible, a pre-gel of Tixogel® VP or MP milled into a solvent / resin base may also be used to reduce manufacturing time. Tixogel® EZ-100, MP-100, MPI, and MP-150 are self-activating organoclays that can be directly added to the batch during manufacturing under low or high shear conditions. Organoclay loading levels vary with the type of ink and equipment, but typically range from 0.5% to 4.0% of the total formulation weight.

### Basic Ink Rheology

In years past, rheology of inks was characterized by the terms "long", and "short", and "body", which describe the apparent flow of

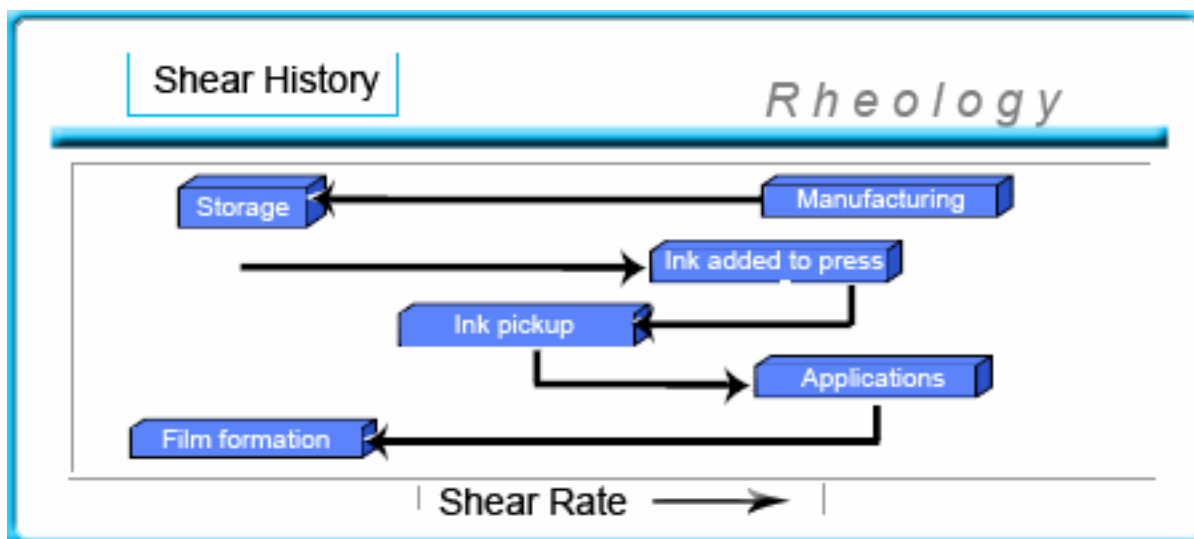
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the ink. However, these terms more appropriately describe the yield value, rather than the viscosity or flow properties. Yield value technically refers to the minimum amount of shear stress required to initiate the flow of ink. Tack is a term that refers to the measurement of the cohesion of ink, or the resistance of an ink film to splitting upon transfer from roller to roller, on an ink application train. Misting is the term commonly used to define a fine spray of ink being thrown off a fast moving set of ink train rollers. Both tack and misting reflect the elastic component of viscosity of the ink.



Colloidal systems, including inks, exhibit varying degrees of pseudoplastic flow properties. That is, flow increases (viscosity decreases) as shear applied to the ink increases. If the viscosity recovers slowly with time after the shear stress is removed, the behavior is described as thixotropic. The formulator must balance the rheologically active components in the ink to obtain the degree of viscosity sensitivity to shear stress and time required for the application.

### Ink Systems and Organoclays

Letterpress ink systems are viscous, tacky systems that dry primarily by oxidation of the resin or drying oil component. Initial setting of the ink occurs by absorption of the ink into the substrate and through evaporation, which can be accelerated through heating. News inks are an exception because they dry solely by absorption into the substrate and therefore require a fluid / paste consistency.

Organoclays, because they will swell in the presence of solvents and do not absorb it from the formulation, are used to increase tack in Letterpress systems. They also reduce misting in low tack Heatset and News inks or in combination with varnishes in medium and high tack ink systems due to their thixotropic nature.

**Lithographic** printing is commonly referred to as "offset" – either Sheetfed or Web Offset. Offset inks are typically high in viscosity and require long trains of ink transfer rolls that split and redistribute ink on the press. A thin film is formed for transfer to the printing plate that, in turn deposits the impression onto the substrate. Offset inks are formulated to run in the presence of water (fountain solution), which is used to create the non-image areas of the printing plate. Chemical and viscosity stability is important due to the interaction between the ink and the fountain solution used on the press. Organoclays are utilized to produce high application viscosities that also work to minimize emulsification of the fountain solution (water pick up).

**Flexographic and Rotogravure** are both low viscosity ink systems, but the printing processes are different. Flexography involves a flexible raised rubber printing plate that deposits an impression on the substrate. Rotogravure involves a mechanically or chemically engraved cylinder that carries ink in small cells that deposit it directly on the substrate. Both types of ink typically have high enough total solids to permit press side solvent thinning to press viscosity. Press side adjustments for various drying speeds to balance the ink, substrate, air temperature, and circulation rate on press are possible. Organoclays are used primarily for antissettling in these type systems

### Manufacturing of Inks with Tixogel®

Manufacturing capacities must be considered when selecting a Tixogel® organoclay. Inks can be prepared either in a batch manner, or in continuous flow processes. In systems where the ink cannot be reduced to its final specification with homogeneous mixing alone, higher energy milling or dispersing equipment is used to produce final ink. The entire process must be considered in selecting a Tixogel® organoclay to obtain maximum benefits.

### Conventional Tixogel® Organoclays in Printing Inks

Tixogel® VP and MP are high efficiency, conventional organoclays that require the use of a polar activator to achieve maximum rheological efficiency and storage stability. Viscosity is generated through a “network” of edge to edge, hydrogen-bonding bridges between adjacent clay platelets. Water is an effective hydrogen-bonder and plays a vital role in activating and stabilizing organoclay gel systems. For this reason, it is recommended that activator / water (95:5) combinations are utilized for optimum performance. If chemical interactions occur obstructing this bonding network, the gelling effectiveness of the organoclay is diminished. The polarity of solvent, resins, and additives in the ink also contribute to the activation of the organoclay, especially at elevated temperature during the manufacturing process. This additional activation must be taken into account when selecting the optimum level of polar activator to add to the ink.

Typical polar activator types and levels commonly used are:

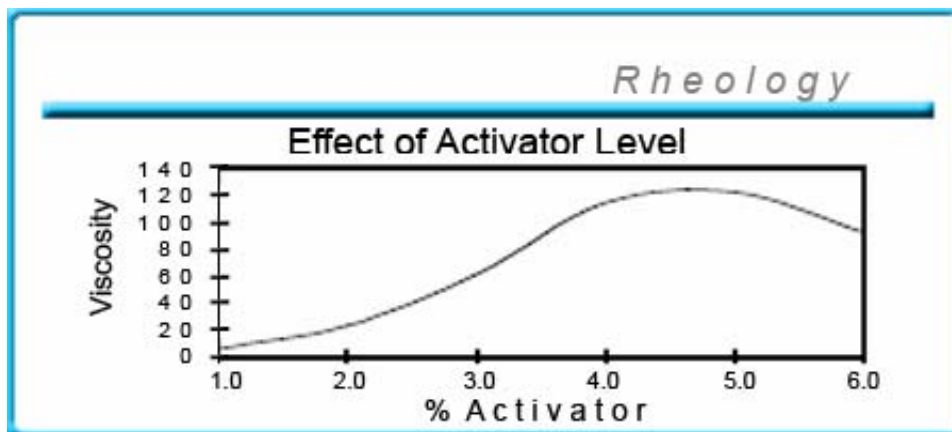
Activator type Level\*

Methanol / Water (95:5) 20 – 40%

Ethanol / Water (95:5) 30 – 50%

Propylene Carbonate / Water (95:5) 20 – 40%

\*Based on weight of organoclay



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Conventional organoclays like Tixogel® VP and MP are well suited for use in high shear milling equipment such as media mills or three roll mills. They can also be effectively used as pre gels. The pre gels would consist 10 to 15% organoclay in some of the resin / solvent of the ink formula. Typically, these pre gels are prepared by high speed mixing, and remain stable over long periods of time.

Application areas for Tixogel® VP and MP primarily involve black and color newsink where incorporation and activation can be achieved before the addition of dry pigments and prior to high-energy milling. They can also be used effectively as concentrated pre gels in conjunction with Flushed color in Cowles mixing.

### **Self-Activating Tixogel® Organoclays in Printing Inks**

Tixogel® EZ-100, MP-100, MPI, and MP-150 are selfactivating organoclays that do not require the use of a polar activator for gelling. They are also well suited for all types of processing shear conditions. Self-activating Tixogels® can also be utilized to post correct the viscosity of a finished ink system under moderate shear conditions.

### **Tixogel® Organoclay Loading Level Suggestions**

The overall viscosity of an ink system is the result of a combination of factors – from pigment selection to processing equipment. Varnishes and solvents also play an important part in the final ink viscosity. Due to all the variables in this challenging application, the following summaries are ONLY suggested starting points.

#### **TYPICAL TIXOGEL® ORGANOCLAY LOADING LEVELS**

System type Loading Level\*\*  
Publication Gravure 0.5 to 2.0%  
Heatset 1.0 to 3.0%  
Sheetfed 1.0 to 2.0%  
News Ink – Black 0.5 to 2.0%  
News Ink – Color 1.0 to 4.0%  
\*\* Based on total formulation weight

*For more information on how Southern Clay Products can assist you,  
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