



Crazing/'Mud-Cracking' v1.1

The effects of crazing or "mud-cracking" of a waterbased coating film is a phenomenon that appears more commonly in today's printing environment compared to just a few years ago. Previously, the improvements in ink drying, fountain solution chemistry, printing press drying systems and the use of multiple-roller/nip application systems provided an optimum balance of ink drying speed, applied wet/dry coat-weight and coating-film drying to avoid any opportunity for crazing to develop. In the modern printing world, changes to printing consumables to meet the growing demands of environmental consciousness and increased productivity of modern printing equipment has impacted the lithographic printing process as it pertains to drying capabilities. Additionally, anilox systems are being supplied as standard equipment on printing machines with coating capabilities. The combination of using 'eco-friendly' inks/fountain solution along with anilox application systems providing marginal and non-adjustable coating-film thickness, the opportunity for crazing in the printing process has once again become a concern for printers.

Misunderstanding of the physical effect of crazing and the contributing factors in the printing process that lead to crazing is largely responsible for the occurrences we see. Having a better understanding of what actually causes crazing to occur, and how the printing materials and machine operation used impact this effect will be helpful in preventing any appearance of this mysterious quality defect.

Crazing/'Mud-Cracking' Effect

Crazing Cause

Crazing or 'mud-cracking' is the development of cracks/fractures that form on the surface of a coating-film or glaze. Crazing is most common in the pottery industry, where glazes are applied to clay pieces, then fired in a kiln for curing. If the glaze film dries and shrinks more rapidly than the clay surface beneath, the tension created in the contracting glaze-film causes it to break-apart creating a noticeable pattern of cracks/fractures. This same effect can occur in the printing industry resulting in visible cracks in the waterbased coating-film when applied in-line over saturated conventional ink areas.

The easiest explanation for crazing with waterbased coating products is that the drying rates for the applied coating-film and beneath ink-layers are too different; the coating-film is drying too quickly compared to the beneath ink-layers. As a waterbased coating-film dries by losing diluents, predominantly water, the film dimensionally shrinks in size in both thickness and surface-area. The same holds true for conventional inks which will lose diluents and fount during the drying process and dimensionally shrink. Ideally, the applied coating-film and beneath inks-layers will dry at a comparable rate, and thus shrink at a comparable rate. In situations where crazing occurs, the coating-film and ink-layers set/dry and shrink at significantly different rates, with the coating-film drying more quickly than the beneath inks-layers. This drying rate difference can result in the coating-film shrinking while the beneath ink-film remains dimensionally stable. When this occurs, the beneath ink-layers resist and hold the shrinking coating-film in place as the coating-film physically shrinks. This resistance causes the shrinking coating-film to break-apart, resulting in a cracked/fractured film surface that creates visible defects in the appearance of crazing or 'mud-cracking'.

Crazing is typically found in printed/coated sheets that have the opportunity for the coating-film to set/dry most quickly; the top sheets of the delivery-pile or pull-sheets that have been removed and placed on the press console. Captive sheets within the delivery-pile which have evaporation slowed generally do not exhibit this effect. In severe cases, each printed/coated sheet can exhibit crazing regardless of being captive, making the sheets potentially un-sellable. Crazing effects are irreversible, however, as the ink-

Crazing/'Mud-Cracking' Effect - *continued*

Crazing Cause *(continued)*

layers continue to dry and shrink beneath the fractured coating-film, the crazed coating-film 'pieces' can be pulled back together making the appearance of the effect less visible or even negligible.

The most common explanation for crazing is that the 'coating is drying too quickly'. While this could be the case, a more accurate explanation is that the drying rates of the ink and coating-films are too far apart/contrasting, meaning that the coating-film is setting/drying too quickly relative to the setting/drying speed of the beneath ink-layers. This is not necessarily the sole responsibility of the coating, but could instead be a result of the ink film-thickness/formulation, fountain solution chemistry, substrate and/or drying system capabilities/operation. The direct cause of this difference in setting/drying rate between inks and coating can be singular, or a collection of variables in the printing process.