A NEW DIGITAL PLATE

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Abstract: In continuation of our previous works a new thermal plate was developed which is suitable for application at CTP systems equipped with IR-lasers (from 0,83μm to 10,6μm).

Introduction

The first systems for direct (filmless) platemaking were equipped with visible lasers (Al_2O_3 - Ruby, He-Ne, He-Cd and Ar-ion) and required photosensitive silver halide or photopolymeric plate materials application.

Although one of the main advantages of CTP technology represents silver-containing materials and additional treatments elimination even now after more than 25 years of *R* and *D* works of the 600 CTP systems currently in operation over 60% are using silver halide plates and around 80% of them are using blue Ar-ion (488μm) or green frequency-doubled YAG (532μm) lasers.

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A proven silver halide technology applied at these systems includes development after laser recording and requires additional equipment, “wet” processes and environment problems.

In the last few years CTP thermal technology opened up a lot of such possibilities like processless platemaking, on-press imaging and plateless printing. Though thermal plates require far more energy than plates exposed by visible light and use the extra energy to start chemical reactions or physical modifications in the plate coating this enables simpler processing and far sharper images.

It might even eliminate the need of processing altogether either by ablating the coating to form a printable area or by changing the surface properties from hydrophilic to hydrophobic.

Since thermal plates are sensitive to infrared energy these materials can be used in daylight thereby making CTP using much more comfortable.

On the other hand up today thermal plates possess a rather low energetic sensitivity in comparison with photosensitive materials thus a laser recording speed and a total process productivity in this case might be insufficient.

Some other problems are also available connected with environment pollutions as a result of laser radiation and coating materials interaction.

Nevertheless the recent international graphic arts exhibitions were full of thermal CTP platesetters and plates of all the leading companies.

Results and discussion

Since the Russian CTP systems are using CO_2 and YAG/Nd-lasers INPOL Co. is interested in *R* and *D* of the coatings for thermal plates in which the following IR laser beam radiation effects are realized:

- thermal crosslinking;
- surface properties conversion;
- thermal ablation.

Thermal crosslinking.

The coating consists of pretreated poly (vinyl alcohol), acid catalysts and Cr-containing sensitizers. The laser beam radiation (1.06 or 10.6μm) effect results in dehydration of PVA molecules and consequent formation of insoluble crosslinked complexes. The energetic sensitivity of such a coating is sufficient for laser recording but it is necessary to take into account the availability of simultaneously proceeding concurent thermal crosslinking and thermal ablation of the coating.

Surface properties conversion.

A grained and specially anodized aluminium plate (the thickness of Al_2O_3 -laser is equal or more than 2.5-3.0μm) pretreated in Na_2SiO_3 - or Cr - containing solutions is used as a recording coating.

The laser beam radiation (10.6μm) effect results in the irreversible conversion of initial hydrophilic properties of the plate surface to hydrophobic ones and it becomes ink-receptive.

The possible explanation of the process might be the formation of some Al-Si or Al-Cr complexes initiated by a sharp heat shock. It is known that Al_2O_3 exhibits strong absorption in the far IR and the energy absorbed transforms to heat.

Thermal ablation.

From a practical point of view a thermal ablation of a polymeric coating is the simplest and the most direct result of IR-laser beam radiation effect and in this case the ablatable coating should meet the following requirements:

- a low thermal stability;
- a low thermal conduction;
- a specific thermal destruction mechanism including simple gaseous compounds formation in order to eliminate additional treatments of the plate after laser recording.

A significantly high radiation intensity and absorbing particles concentration are required to achieve the complete ablation of the polymeric layer as the result of the IR-heating. It is known that IR-heating at first leads to an increase of the molecules vibrational energy and then the energy is distributed between the rotary and translational degrees of freedom. The molecules decomposition may accompany the excitation of all degrees of freedom. If the energy distribution preceeds decomposition then the reaction induced by the laser radiation doesn't differ from the usual thermochemical one.

The absorption of the laser radiation by non-transparent polymers takes place in a very small volume of substance. Then a high temperature heating occurs and the polymers decomposed according to the usual thermolysis mechanism with an elementary gaseous substances formation. The complete vaporizing ablation of the polymeric layer is reached only when this layer absorbs the IR-laser radiation well and decomposes under its action to volatile products or to some substances which are easily removed.

The IR-sensitive and simultaneously imaging coating of the new plate is single-layer and represents a dispersion of IR-absorbing dyes and pigments mixture in a polymeric binder. Low values of thermal stability and conduction facilitate the coating removal from the areas exposed by the IR laser beam radiation and ensure the absence of edge effects of the printing elements.

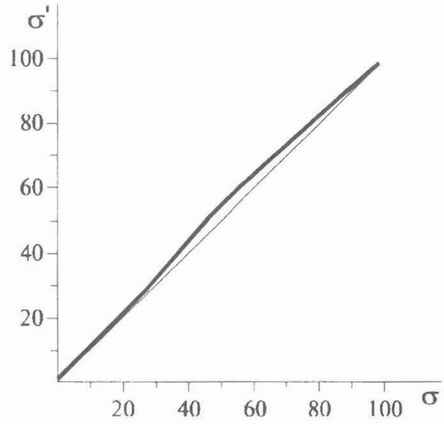
As a result of laser radiation effect the polymeric coating is destroyed in the exposed areas thus forming non-printing elements on the metallic support. The remaining portions of the coating are ink-receptive and serve as printing elements. Comparative technological tests of three types of plates in both laser recording and offset printing showed the advantages of ablatable plates.

After laser recording these plates need no additional treatments and are ready for conventional offset printing like usual positive presensitized plates. Performance characteristics for the plates include (1) energetic sensitivity 0.6-0.8J/cm^2; (2) unlimited shelf-life; (3) no special requirements for the printing process; (4) ≥200 thousand copies.

Technological Tests

The new plate was tested in the processes of laser recording and following printing. In order to estimate the plate technological properties and its suitability for practical using a special Test Form containing halftone images, a tone scale and a type resolution target was prepared.

The dot sizes on the printing plates and prints were measured using Macbeth densitometer and the line widths were measured using an interference microscope. The following figures demonstrate the test results.



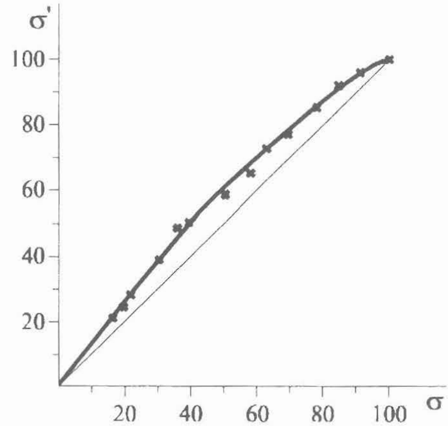
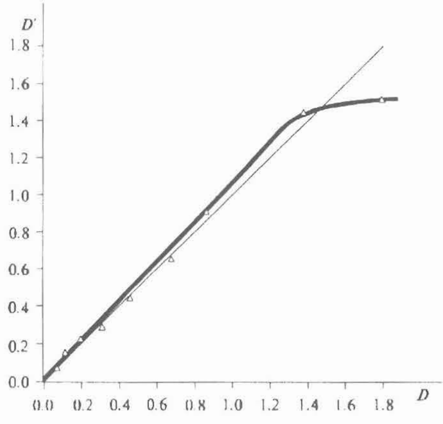


Figure 1. σ'-σ dependence (dot gain).

Figure 2. σ'-σ dependence (dot gain).

Figure 1 and 2 show σ'-σ dependencies (dot gain) for different screen rulings (72 and 180 dpi).



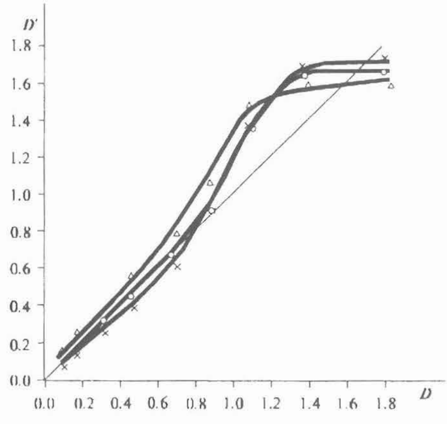


Figure 3. D_{print}-D image dependence

Figure 4. D_{print}-D image dependence (in the printing process)

Evidently the dot gain depends on the screen ruling value in proportion to its increasing but even in the second case it is less than 10%.

Fig.3 demonstrates D_{print}-D_{image} dependence (gradation curve) and Fig.4 shows its deviations during the printing process.

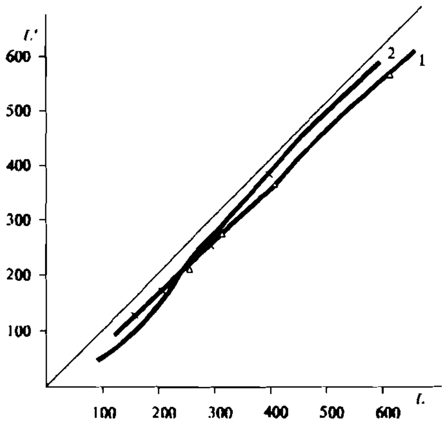


Figure 5. The line width deformation. 1 - resolving test-object, 2- displaying test-object

Figure 5 shows the deformation of the line width (L_{print}-L_{image} dependence). This deformation is negative but permissible.

Conclusion

The first tests shown that the new plates meet necessary requirements and may be applied for plate-making. Their full-scale production is under way now.

References'

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