



TEST REPORT

| | |
|--|---|
| Test No. | IAUF-11-002 |
| Your order of | 12 January 2011 |
| Receiving of samples in the lab | 17 January 2011 |
| Period of Investigation | 17 January – 30 March 2011 |
| Samples | Labels of two different grades (Quality 3 and Quality 5) on original substrate and on library binding material |
| Method of analysis | Surface pH value according to ZM V/17/80 before and after accelerated ageing (Moist heat treatment according to ISO 5630-3 at 80°C and 65 % relative humidity conditioning for a period of 60 days) |

| Sample No. | Sample description | Surface pH values | | | Mean | |
|------------------|--------------------------------------|-------------------|---------------------|------|------|------------|
| Quality 3 | | | | | | |
| 28/11 | White without colour | Before ageing | 8.12 | 7.93 | 8.00 | 8.0 |
| | | After ageing | 8.00 | 7.80 | 7.70 | 7.8 |
| 29/11 | Hot foil print | Before ageing | 7.70 | 7.81 | 7.74 | 7.8 |
| | | After ageing | 7.60 | 7.70 | 7.55 | 7.6 |
| 30/11 | Thermotransfer printing | Before ageing | 7.90 | 7.98 | 7.55 | 7.8 |
| | | After ageing | 7.42 | 7.30 | 7.48 | 7.4 |
| 31/11 | Thermotransfer printing and laminate | Before ageing | Sample not wettable | | | |
| | | After ageing | Sample not wettable | | | |
| 32/11 | Original substrate | Before ageing | 8.31 | 8.22 | 8.16 | 8.2 |
| | | After ageing | ---- | ---- | ---- | ---- |

| Sample No. | Sample description | Surface pH values | | | | Mean |
|------------------|--|-------------------|------|------|------|------------|
| Quality 5 | | | | | | |
| 32/11 | White without colour | Before ageing | 7.75 | 7.77 | 7.82 | 7.8 |
| | | After ageing | 8.65 | 8.25 | 8.40 | 8.4 |
| 33/11 | Single-coloured hot foil print | Before ageing | 8.21 | 8.15 | 8.10 | 8.2 |
| | | After ageing | 8.05 | 8.55 | 8.55 | 8.4 |
| 34/11 | Single-coloured hot foil print, holohedral | Before ageing | 7.20 | 7.16 | 6.85 | 7.1 |
| | | After ageing | 7.58 | 7.40 | 7.45 | 7.5 |
| 35/11 | Single-coloured hot foil print, holohedral with laser printing | Before ageing | 7.19 | 7.05 | 7.35 | 7.2 |
| | | After ageing | 7.35 | 7.08 | 7.15 | 7.2 |
| 36/11 | Original substrate | Before ageing | 8.30 | 8.39 | 8.30 | 8.3 |
| | | After ageing | ---- | ---- | ---- | ---- |

Evaluation of test results

The investigated samples of both label grades (Quality 3 and Quality 5) on the original substrate (siliconized paper) show surface pH values of 8.2 and 8.3 in the alkaline range. After printing the labels with the above mentioned printing technologies the surface pH values are slightly lower. Before ageing, all printed samples show surface pH values in the neutral to low alkaline range (pH values between 7.1 and 8.2).

The accelerated ageing in moist heat atmosphere at 80°C and 65 % relative humidity is carried out to simulate chemical reactions, which are not only affected by the temperature, but also by the presence of water. In paper material the hydrolytic degradation of cellulose is a process that should be strongly accelerated under these ageing conditions. Effects of the hydrolytic degradation are losses of strength and brittleness of paper.

In the present investigation, after the accelerated ageing of the labels, all determined surface pH values exceeded 7.0. Values lower than 7.0 can be an indicator for a beginning hydrolytic degradation of the cellulose fibres. In case of the investigated label material of the grade "Quality 3" a slight reduction of the pH values by 0.2 pH units was observed after the ageing process. The measured pH values after the accelerated ageing of the label samples of the "Quality 5" increased by 0.2 to 0.4 pH units or remained constant.

Due to these results it can be stated that the tested labels show a high resistance to ageing. The tested long ageing period of 60 days is 2.5 times higher in comparison to the test conditions according to DIN 6738:07. Here a maximum ageing period of 24 days for ageing resistant paper is planned.

After the 60 days moist heat treatment neither yellowing nor reduction of colour intensity were observed. Obviously, the adhesive force of the labels on the surface of the substrate was not affected.

In case of careful treatment and storage, papers, which fulfill the requirements of the highest length of life class LDK 24-85 to DIN 6738:07, do have a durability of more than several 100 years, based on today's state of knowledge. Additionally, the investigated paper samples of both label grades (Quality 3 and Quality 5) completely meet the demands of DIN EN ISO 9706:2010-02 "Information and documentation-Paper for documents-Requirements for permanence".

pp. 

Dipl.-Chem. Antje Kersten
Laboratory Manager Chemical Laboratory
Scientific Staff

Darmstadt, 11 May 2011