Recordable Blu-ray Disc Process Control

dr.schwab Inspection Technology GmbH

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dr.schwab Inspection Technology

has been founded with the specific goal to develop a new generation of inspection technology for the third generation of pre-recorded and recordable Optical Discs.

With our focus on development we are flexible to changing requirements in production and able to provide feedback to optimize the complex manufacturing processes.

We understand ourselves as a partner for leading companies providing up-to-date inspection technology as well as customized solutions.
Optical Disc Evolution

1st Generation Saturation Phase

2nd Generation Growth Phase

3rd Generation Start-Up Phase

Annual Production [millions]

CD-ROM
CD-R
DVD-ROM
DVD-R
BD-ROM
BD-R

BD-R Formats & Technology

**Material:** Inorganic (HTL) versus Organic (LTH)

Verbatim Blu-ray BD-R LTH Type

**Speed:** 1X, 2X, 4X ...

FUJI 5x BD-R Blu-Ray Double Layer

**Capacity:** Single, Dual, Quadro ...

TDK unveils 320GB 10 layer Super-Multilayer BD-R optical disc at CEATEC
Challenges in Dye Coating

Phase Depth vs Dye Fillgrade
Challenges in DL Recording

- Intensity reduction by L1
- Possible cross-write and cross-talk
DL Basic Considerations

- Optimize recording power and read-out signal
- Minimize cross-write and cross-talk
Recording Power Optimisation

Graph showing the relationship between Read-Out Signal and Transmission T1. The graph includes two curves labeled S1 and S0, with points A0 and A1 indicating specific values.
Tasks of Physical Testing

Not only check the Quality (Function) But also optimize the Process (Productivity):

- Measurement on each process stage
- Measurement of the complete distribution
- Fast with respect to production cycle
- Correlation with process parameters
- Correlation with Functionality

Providing the link between Process and Function
period $\delta \lambda$ determines layer thickness: $d = \frac{\lambda}{2n\delta \lambda}$
range $\Delta \lambda$ determines lower limit: $d_{\text{min}} = \frac{\lambda}{2n\Delta \lambda}$
QL-BD Layer Thickness

Example: Quadro Layer BD Space Layer Thicknesses

\[ d = \frac{\lambda^2}{2n\delta\lambda} \]

Spectral Reflectance

FFT Spectrum

SLT_1 : SLT_2 : SLT_3
1 : 1 : 1
Space Layer with L1 Bumps

Even local events can be detected and classified
Statistical Process Control
Multiple DCUs (Data Collecting Units) managed by a Host Computer

Multiple measurement stations connected to an SQL Server via TCP/IP
Yield Trend Analysis

Many causes ➔ Random Variation
CLT Trend Analysis

Single cause ➔ Systematic Variation
Physical Testing provides the link between Process and Function, optimizing:

- Function (high quality)
- Productivity (high yield)

Economy = Quality * Productivity

which is prerequisite for the Sustainability of Optical Disc Business
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