

# Dual Layer Technology for DVD-R (8.5GB)

Developing a Dual Layer Disc for DVD-R with the same parameters as the dual layer DVD-ROM

## Overview

On October 3, 2003, Pioneer announced the technical development of a recordable disc that has the same physical parameters as a single-sided dual layer DVD-ROM. It has a capacity of 8.5GB and a recording layer in the same position as DVD-ROM, and also has the same physical characteristics as DVD-ROM after recording, including jitter values. Because it is made to operate in the same recording mode as DVD-R, it enables high compatibility and recording and playback from a single side.

It allows continuous video recording and playback of approximately four hours in standard mode and approximately twelve hours in long play/record (triple) mode for CE recording devices and its capacity is approximately double that of PC devices.

	Dual Layer R	Dual Layer DVD-ROM
User data capacity	8.5 GB	8.5 GB
Track pitch	0.74 $\mu\text{m}$	0.74 $\mu\text{m}$
Channel bit length	0.147 $\mu\text{m}$	0.147 $\mu\text{m}$
Reference scanning velocity	3.84 m/sec	3.84 m/sec
Reflectivity	18 to 30 %	18 to 30 %
I14/I14H	0.60 min	0.60 min
I3/I14	0.20 min	0.20 min
jitter	< 8.0 %	< 8.0 %
Addressing method	Wo+LPP	

Table 1. Specification of Dual Layer Disc for DVD-R and Dual Layer DVD-ROM

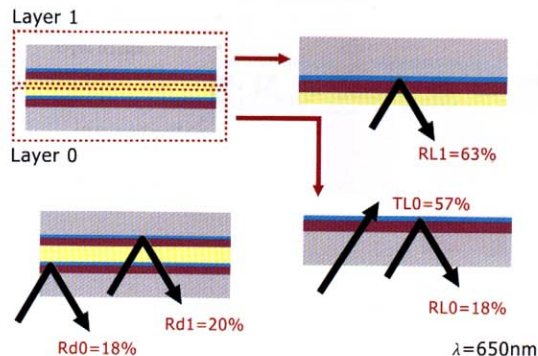
## Background

The market for the DVD family of products (DVD-ROM, DVD-Video, DVD-Audio, DVD-R/RW/RAM) is showing rapid and continuous growth. Particularly, DVD recorders that use DVD-R/RW/RAM are increasing their share as a replacement for VCRs in the personal recording market. Also, recent PCs have DVD functions as standard peripheral equipment. Along with such popularization of DVD, users have a strong desire for recordable media with higher convenience and larger capacity.

This newly developed disc with the same physical parameters as single-sided dual layer DVD-ROM and the same recording mode as DVD-R realizes a capacity that is double that of a conventional disc and has high compatibility with the DVD family established by the DVD Forum. It can be easily accommodated in future drive designs and delivers a number of significant advantages to consumers.

## Technology

The highlight of this development is the use of our own simulation technology to determine the physical structures such as the multi-layer structure of the dual layer disc and the groove shape of the substrate. As a result, we could perform pinpoint optimization for dozens of configuration parameters and complete the development within a short period.



Dye layer  $n=2.2$   $k=0.08$  averaged thickness=68nm  
 Semi transparent layer reflector  $n=0.19$   $k=5.34$  thickness=10nm  
 Reflective layer reflector  $n=0.19$   $k=5.34$  thickness=70nm

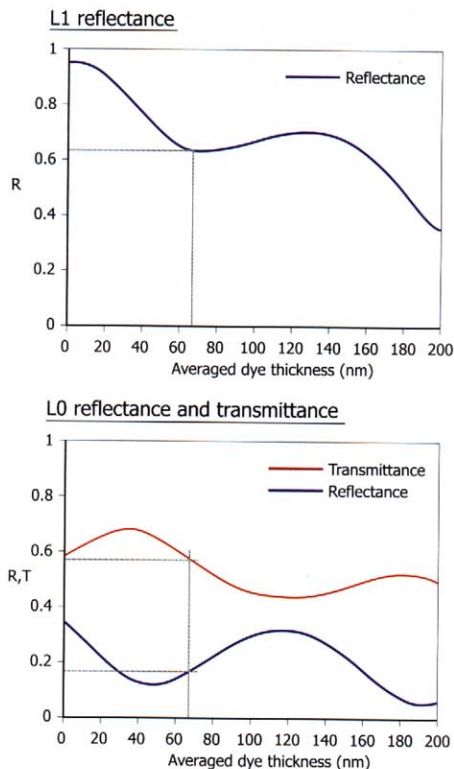


Figure 1. Simulation results

## Principle of Dual Layer Disc for DVD-R

Dual Layer Disc for DVD-R records by concentrating the laser beam on the recording layer in order to heat it. The change in the refractive index caused by pyrolysis of the dye-recording layer is mainly used for forming the recording marks. The beam spot diameter is narrowed down to  $0.5\ \mu\text{m}$  at the laser beam focus point. At the same time, since the diameter is widened to  $40\ \mu\text{m}$  on the other layer, only one recording layer is heated and recording and playback can be performed by each layer without difficulty.

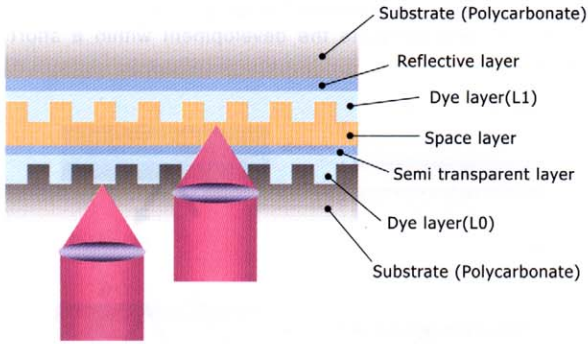


Figure 2. Structure

## Manufacturing Process of Dual Layer Disc for DVD-R

It had been considered difficult to manufacture a Dual Layer Disc for DVD-R, but Pioneer managed this feat by utilizing a manufacturing process that uses soft stampers.

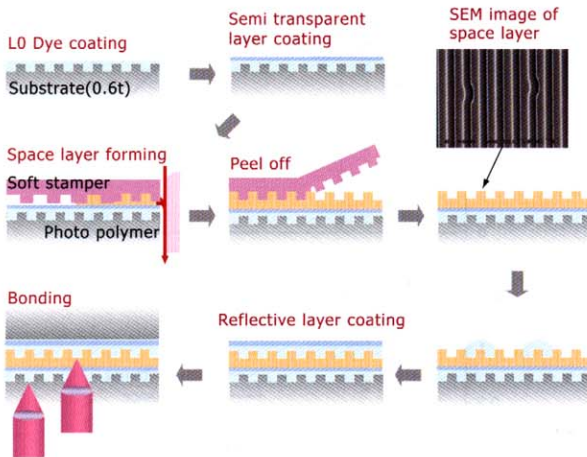


Figure 3. Manufacturing process

## Target Specifications of Dual Layer Disc for DVD-R

User data capacity	8.5 GB
Track pitch	$0.74\ \mu\text{m}$
Channel bit length	$0.147\ \mu\text{m}$
Reference scanning velocity	$3.84\ \text{m / sec}$
Reflectivity	18 to 30 %
I14/I14H	0.60 min
I3/I14	0.20 min
Jitter	< 8.0 %
Addressing method	Wo+LPP
Writing Speed	1x and 2x -
Writing path	Parallel and Opposite

Table 2. Target specifications

## Copyrights

DVD Forum has always given due consideration to copyrights for all recordable media. Appropriate copyright protection measures will also be taken for this newly developed Dual Layer Disc for DVD-R upon its commercialization as one of the DVD family products.

## Future Action for the Dual Layer Disc

Pioneer will propose the Dual Layer Disc for DVD-R to the DVD Forum and do what is necessary for its early standardization as one of the DVD family discs. Since many companies participate in and contribute to the DVD Forum, the DVD specification has concrete technical background based on rich data from the first issuance. Therefore, because most participating manufacturers would be able to manufacture the products when the standards are issued, consumers' expectations can be met without keeping them waiting.