Initialization characteristic comparison low and high speed CD-RW

Yoshiharu Tami, Eiji Sahota

Optical Systems Development Group
Hitachi Computer Peripherals Co., Ltd.

1. INTRODUCTION

CD-RW production was started in 1997 and now it is growing up to about 10 percent market scales of CD-R. The market scale seems to expand by the speeding-up of the writing in the future. We report the difference of the basic characteristics of initialization, which are measured from different kinds of CD-RW.

2. BASIC THEORY OF INITIALIZING

The basic parameters for initializing of phase change recording media are control of the disc rotational speed and irradiation DC laser power. In order to keep relative speed of disc and laser head, the initializer is doing the constant linear speed (velocity) control. And also controls DC irradiate laser power wherever laser head locates on the disc while initializing is done.

In these experiments, we use our initializer, which is remodeled to measure some unique phenomena which is not using in common initializing use.

3. EXPERIMENTS

Figure 1a and 1b show the difference of reflectivity change of two kinds of different writing speed discs. In order to measure the change of the disc reflectivity, we increase the laser power on 1W/sec while initializing is done. The crystallization starts when the condition of linear speed is low and/or irradiation laser power is high in spite of the different recording layer composition. From these measurement results, we found the easy way to grasp the characteristic of the initialization. It is difficult to read out the difference of basic characteristic from Figure1a and 1b.

Showing the translation data from figure 1a and 1b to figure 2a and 2b, we can realize to explain the different characteristic of these two kinds of CD-RW disc. You can guess easily which CD-RW disc is better for high speed writing from the data of figure2a and 2b.

And we continue the evaluation in detail to these discs and find that CD-RW for high-speed writing keeps higher reflectivity to high linear velocity compare to the low speed type. On the side of higher linear velocity in figure2a and 2b, the reflectivity of crystallization declines because the energy for initializing is lacking. On the side of lower linear velocity in figure 2a and 2b, It isn't possible to write the data on the disc because surplus initializing laser energy was irradiated.

These experiments results show that it is possible to guess the optimal initializing condition and the writing speed roughly by measuring this basic initialization characteristic of unknown CD-RW disc.

Also, the precise optimal linear velocity for initialization should be found on the lower side of reflectivity peak with the detailed evaluation. This result is the common to all kinds of the CD-RW discs that evaluated so far. We decided to call this “basis initialization characteristic”.

In addition, We investigated the amorphous speed using initializer function.The purpose of this experiment is to study the relation between the basis initialization characteristic and the actual amorphous speed that is using in CD-RW disc drive.

The initializer optics makes approximately 200 μm length spot size for the direction of the radius. But as for the direction of the circumference, it is approximately 1 μm and this size is almost same as the recording drive. To adjust the power density of CD-RW drive and initializer irradiation laser power to the disc in these experiments, we use the high-density laser head with 75 μm spot width. The power density of this optical head is in range of 5 – 13mW/μm2. And in

these examinations, we use the conventional CD-RW disc. One result of the experiment is shown in figure 3 and the summarily of this experiment is shown in figure 4.

In case of this 4x writing speed disc, the amorphous state appears in 5.5m/sec linear velocity condition and 5.5mw/ μ m2 power density condition as shown in figure4.

In the case of 10x writing speed disc, the amorphous state appears in higher linear velocity and higher power density condition compared to the 4x writing speed disc.

The amorphous speed increases linearly according to increase of laser power density to each kinds of disc. From this result, we obtain the fixed number between amorphous speed and power density of irradiated laser. It merely means the writing power density has relation to the amorphous speed.

Therefore, in the case of 4x writing speed disc that is shown in figure1 and 2, there is the possibility that the two different phenomena should be occurred in same time, that is the change from as Depo State to crystalline state and the change from crystalline state to amorphous are observed when initializing is done with condition of 6.5m/sec linear speed.

4. CONCLUSIONS

1. We could find that the measurement of the basis initialization characteristic is effective to judge the difference of CD-RW initialization condition.

2. 2.In case of 4x writing speed CD-RW disc, there is possibility that the crystalline state discs could change to the amorphous state when initializing are done by approximately 6.5 m / sec linear speed or more.

REFERENCE

1. E.huber and E.E.Marinero: 1987 The American Physical Society Vol.36 No.3

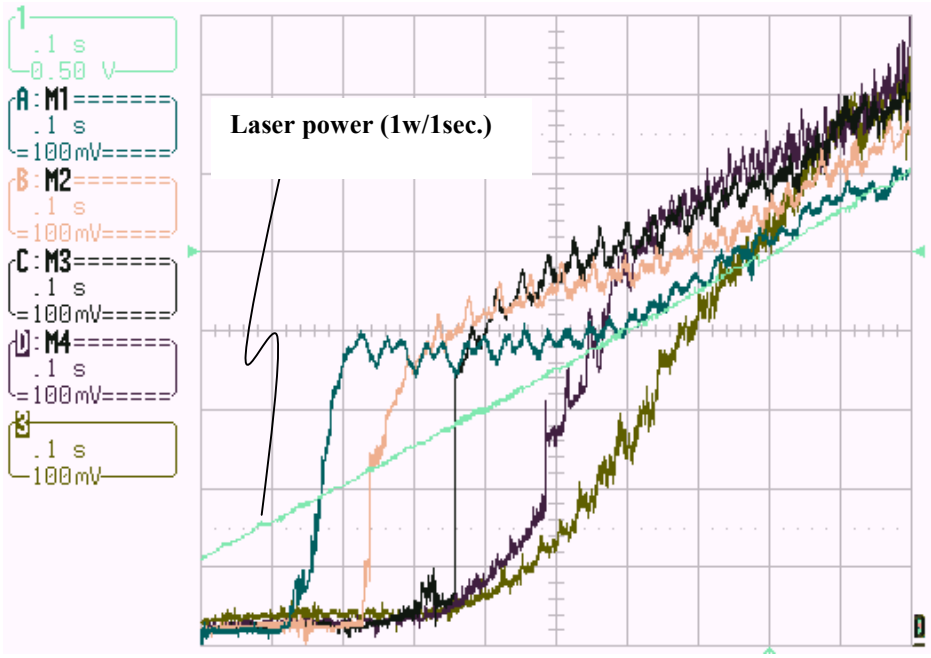

Fig.1a Reflection signal dependence on initializing laser power

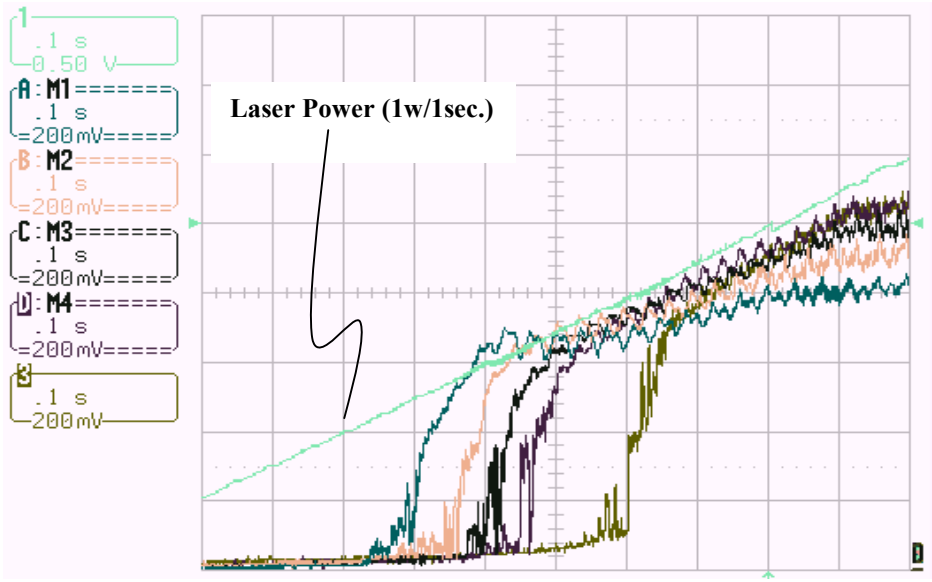

Fig.1b Reflection signal dependence on initializing laser power

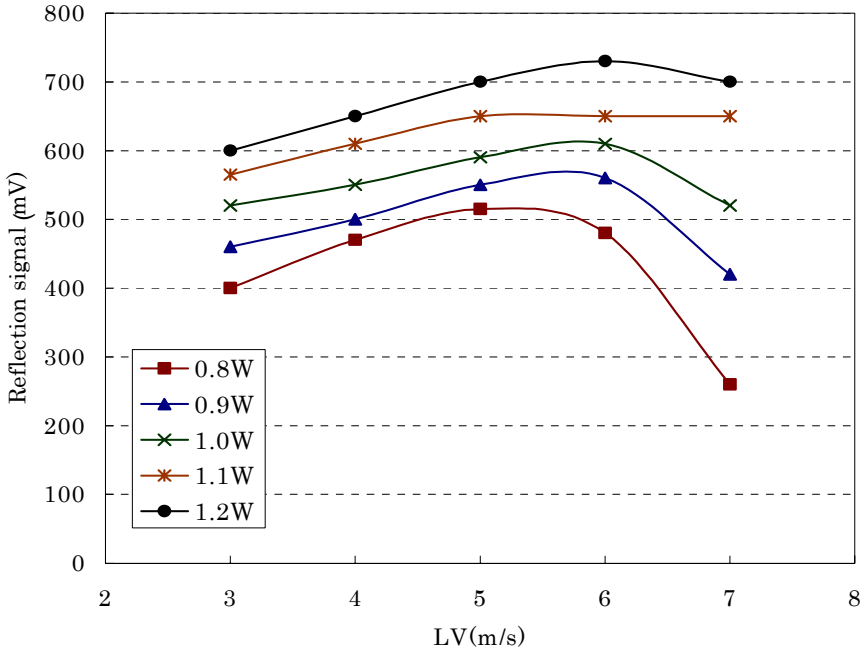

Fig.2a Reflection signal dependence on linear velocity (Low speed type)

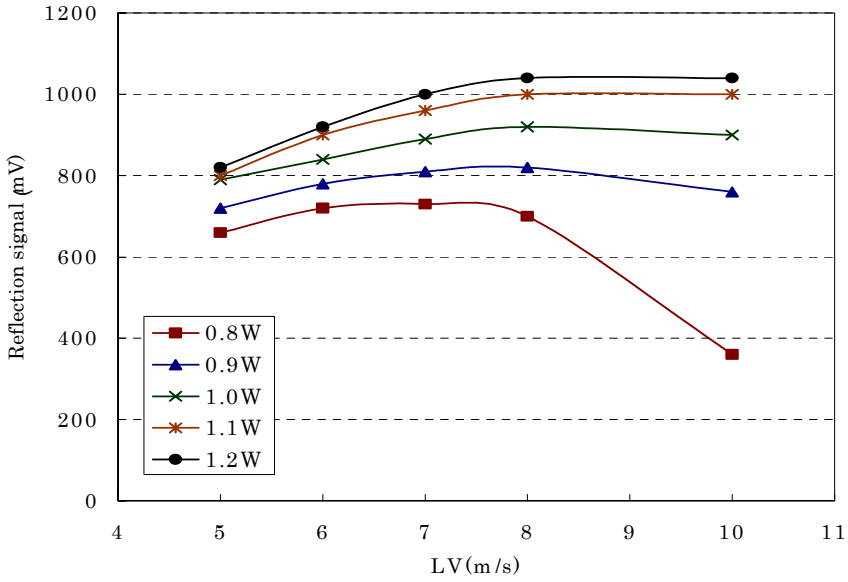

Fig.2b Reflection signal dependence on linear velocity (High speed type)

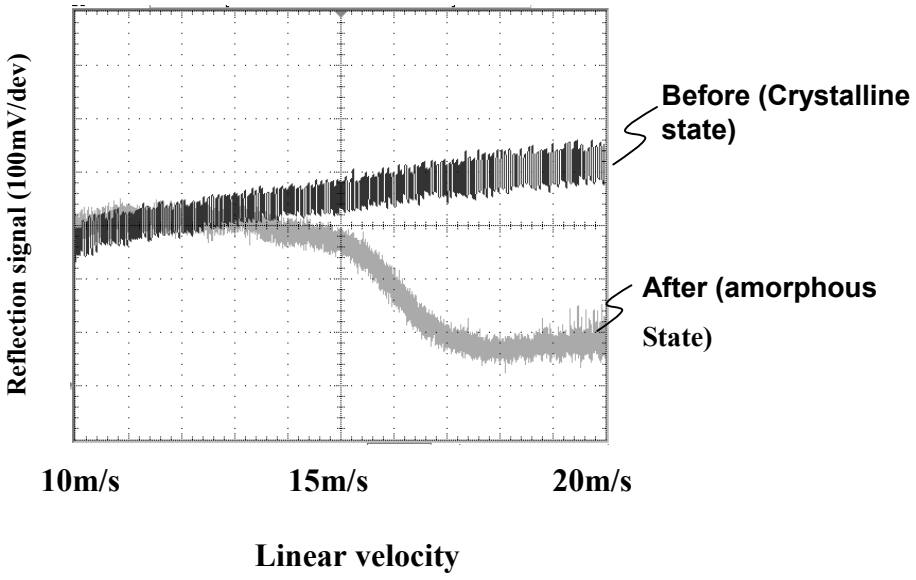

Figure 3 Reflection signal dependence on linear velocity of conventional 10x Writing speed disc

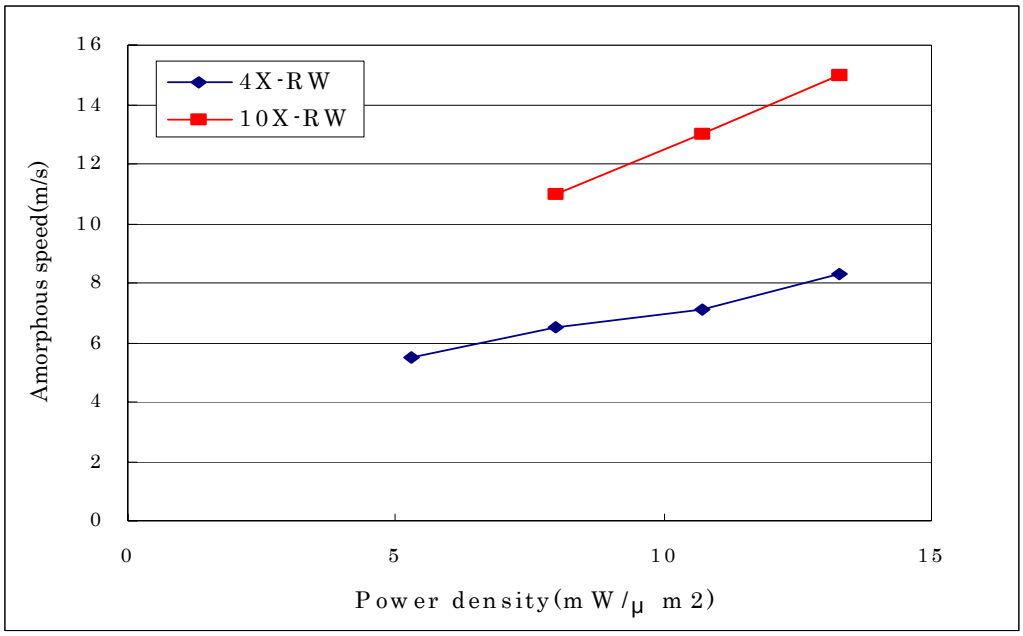

Fig.4 Amorphous speed dependence on laser power density