Life-test Predictions for UDO® Media

A summary of Plasmon's test results that establish UDO media life predictions

Author: Media Development

Version: 1.1
Date: 19 June 2006
Status: Released
Distribution: General

www.plasmon.com

1 Executive Summary

Establishing the operational life of storage media is a key consideration when selecting technology for a data archive. Stable digital media with a long life, can have a major impact on meeting business requirements, planning IT strategies, and managing long-term operating costs. It is therefore important that media life predictions are established using a scientifically rigorous methodology to ensure the greatest possible confidence in the longevity of the media.

The issue of lifetime prediction for optical media is a complex subject. True lifetime prediction based on a statistically valid technique is a time consuming process and this can only be started when the drive and media are in their final production configurations. As a typical full life test takes 6 to 9 months or more to complete this inevitably means that product is shipped before the formal life test data is available. Plasmon has now completed extensive accelerated testing on 30GB UDO (Ultra Density Optical) media, which confirmed that Rewritable media has a 53 year media life and the exceptionally stable UDO Write Once media established a 180 year media life.

2 Typical practice in the Industry

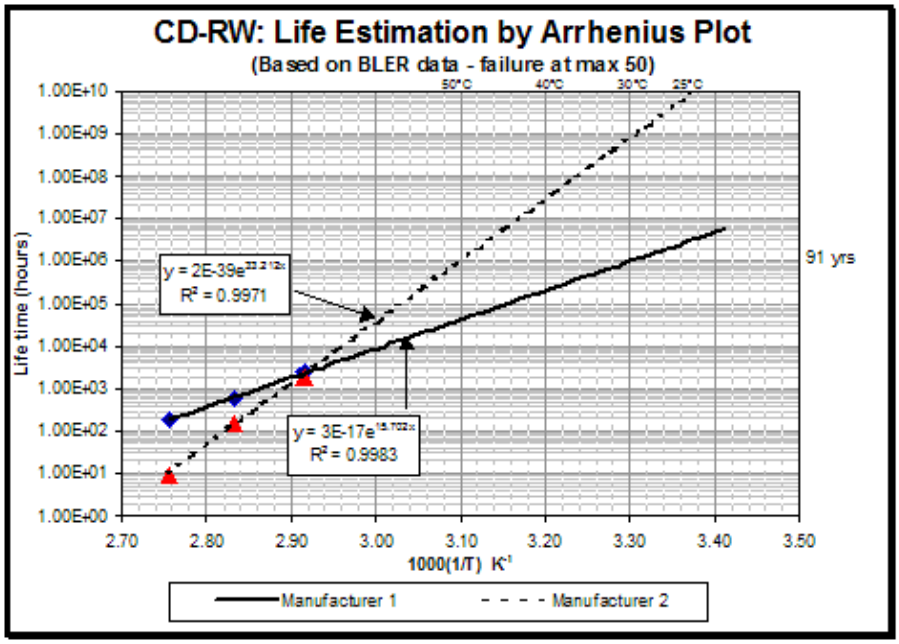
Phase Change and Magneto Optical (MO) media has historically been tested by the Arrhenius method, which involves testing at three (or more) temperature/humidity points and extrapolating back to the operating environment. The Arrhenius technique is based on known scientific principles and is well established in the professional archive world. This testing methodology has been used with many optical technologies, in addition to microfilm materials. If the fit to the Arrhenius model is good, there is a high confidence in the predictions. Plasmon has always used this methodology to assess the lifetime of previous generation professional optical media (MO) and has applied the same method to lifetime projections for UDO.

2.1 Single versus Multi Point Testing

The key fundamental point to stress is that single point testing employed by some manufacturers of storage media provides absolutely no indication of actual media life under different environmental conditions.

As an example the graph below shows the data from two different CD-RW media manufacturers. The disks were aged at 90, 80 and 70 degrees C and 80% RH. Three different times to failure are plotted in the graph below and the line is extrapolated to a lower temperature to predict the lifetime under normal conditions. As can be seen, at the 70-degree point (where the two lines cross) there was no difference in the predicted lifetime.

However, when all three data points are plotted the two media can be shown to have very different lifetimes when extrapolated to a normal storage environment because of different “rate constants”. The temperature dependences of the failure mechanisms are different for the different media types.



Clearly, it is essential to establish the “slope” of the Arrhenius plot or “rate constant” in order to make the extrapolation from the harsh test to normal storage conditions. Equally, this must be done with media manufactured using final production processes and tested on drives which meet full operating specifications.

A typical practice in the CDR/DVD-R industry is to use one “harsh” temperature/humidity point to test media and to then assert that the result can be applied to a "normal usage lifetime". This methodology makes analytically significant assumptions that the temperature extrapolation constant is well known and based on multi temperature testing. The common supposition is that media passing a one-point environmental test has a definable lifetime (often stated to be over 100 years). These assumptions simply cannot be substantiated by any measure of scientific analysis. This methodology, combined with the fact that consumer CD and DVD manufactures employ a very wide range of different material in the production of their media, makes results from single point testing misleading and inaccurate.

3 UDO Media Test Results

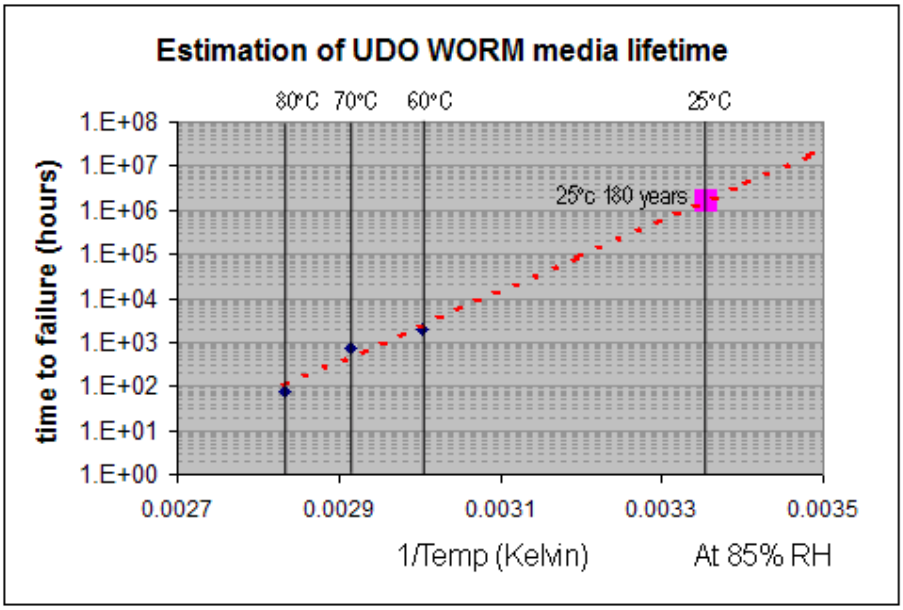
Plasmon has completed life tests on both UDO Rewritable and Write Once media using the scientifically rigorous Arrhenius method at 80, 70 and 60 degrees C and 85% RH, discussed above. Since the recording surfaces of these two media types are dramatically different, it was necessary to test each media type independently. The results are presented below and based on sound scientific principles show that the media exceeds the 50-year lifetime.

3.1 UDO Write Once Media

In the case of UDO Write Once media, the recording film showed no change in characteristics even after prolonged exposure to the severe conditions and no significant change in error rate could be measured.

However, in order to make a prediction of lifetime, a failure mechanism had to be identified. In this case, the distortion of the disks was chosen as this was the only significant change seen in over 12-months of vigorous testing. Plasmon's stringent manufacturing standards were used as the bench mark to establish the failure point of the media. These manufacturing limits are actually very conservative and data can be recovered without error at more than twice the allowable range. In reality, none of the Write Once media tested came close to the error limits specified by the manufacturing standards; illustrating the extreme stability of this media type.

In the graphs below the "end of life" at 80, 70 and 60 degrees C is plotted and extrapolated according to the Arrhenius equation.

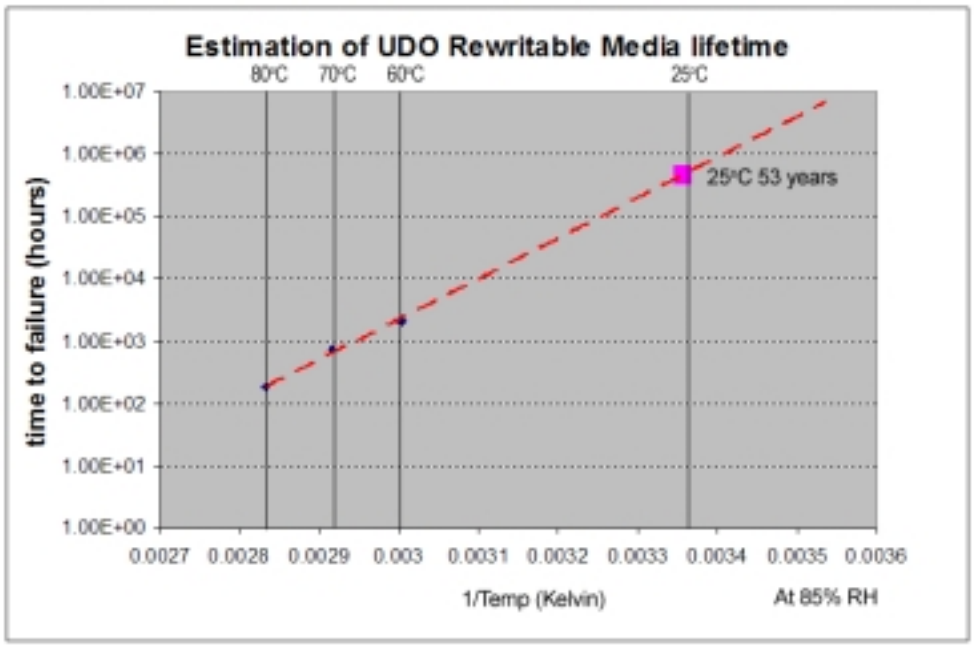


Based on these figures the practical lifetime of Plasmon's UDO Write Once media is much greater than 180 years.

3.2 UDO Rewritable Media

In the case of UDO Rewritable media, some small deterioration of the written marks can be seen after prolonged exposure to severe environmental conditions.

The graph below is based on an increase in error rate of 15 bytes per sector, well within the correction capability of 600 bytes and therefore again the lifetime estimate is very conservative.



Based on these figures the practical lifetime of Plasmon's UDO Re-writable media is much greater than 50 years under normal storage conditions.

4 Conclusion

Plasmon's rigorous Arrhenius test procedure has clearly documented the projected media life for both 30GB UDO Rewritable and Write Once media. Under extremely harsh environmental conditions and with very conservative error rate criteria, UDO Rewritable media demonstrated a 53 year media life and the exceptionally stable UDO Write Once media established a 180 year media life.

While it is extremely unlikely that an organization will maintain records written on UDO media for 50 years, the stability of the media and longevity of the data is a very important consideration in an archive environment. As computer hardware and software evolve, it may well be necessary to migrate archive data to newer storage technologies. What is important is that the length of the migration cycle not be defined by the life of the media. Storage media with a short or unpredictable life imposes a high maintenance burden, risks data loss, and can force an organization into short and frequent migration cycles.

With UDO, there is no demand for media maintenance and no significant risk of data loss over many years of operation. This quality allows organizations to plan long-term and make migration decisions based on business requirements and not the looming threat of data loss. UDO's unmatched data life protects the integrity of data, reduces the frequency of technology migration, and dramatically lowers maintenance and operational expense.