Robust Control for Die Attach Machine Recipe Management System

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

Short Research Article

ABSTRACT

One of the problems facing the Die Attach engineers at Front of Line is the lack of control of their Die Attach Recipes. Currently, all Recipes are stored on a computer that is accessed by all users and transferred to the Die Attach machine using a diskette via a simple file copy operation.
This kind of setup is vulnerable to the tampering of the Recipes, which may lead to problems in the production line, affecting the quality of the product. It is also difficult in the current setup to know which user copied the Recipe or changed its contents, making those activities untraceable. Finally, the manual management of Die Attach Recipes by file copy raises the risk of human error. To increase the quality of production as well as to protect Recipes from tampering, a computer-based program has been developed to fix the issues in the current setup.
The Die Attach Recipe Management System, or DRMS, is a computer program that can do the following: (1) protect the Die Attach Recipes to prevent unauthorized users from accessing and changing them; (2) monitor users who access the Recipes; and (3) simplify the recovery and storage process to eliminate human error problems.

1. INTRODUCTION

Die Attach is the process of interconnecting the die to the leadframe with the use of adhesive material of epoxy or due attach file. As the package becomes smaller with increasing lead counts, the Die Attach process becomes more difficult; thus the repeatability of a good mechanical set-up, right parameters, and correct

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wire layout at the least possible time become essential in the Die Attach process. A Die Attach recipe consists of the following [4]:

1. Workholder parameters – these are the motor parameters that are responsible for indexing the leadframe. It contains the necessary information about the leadframe to be used including the width, length, and spaces between units that vary per package type.
2. Magazine parameters – these are the motor parameters that are responsible for the movement of the input and output magazines that also vary per package type.
3. Process parameters – these are the bond force and pick force parameters that have a direct impact on the output response of the product like the Bondline Thickness and Die Shear Test.
4. Pattern Recognition System parameters – these are the parameters necessary for the accurate placement of the die to pad.

Since most of the Die Attach machines today are fully automated where the mechanical parts are already motorized, these motor parameters can be included in the Die Attach recipe. A technician needs only to retrieve the previously characterized/qualified Die Attach recipe to start the machine set-up [3,4]. The operator in turn will do all the necessary output response checking before the production run.

2. METHODOLOGY

Die Attach Recipe Storage The current way of storing Die Attach recipes is by manually copying the recipes from the Die Attach machine to a computer. Once a Die Attach recipe is qualified, a technician gets it from the Die Attach machine, saves it to a floppy disk, and then copies it to the computer's storage area. Other technicians who will use the recipe will then get it from the computer's storage area, transfer it to a floppy disk then load it into the Die Attach machine. The technician then performs all the necessary set-up, and once the machine passes all the requirements, the machine will go to production mode. Fig. 1 shows how a Die Attach recipe is transferred between the computer and a Die Attach machine.

Storing Die Attach recipes this way, however, does not guarantee that all saved recipes in the computer were qualified recipes since any user can modify the recipes on the computer. Thus, the qualification of the recipes would rely mostly on the skills of the technicians, causing variability in the product response.

3. RESULTS AND DISCUSSION

To prevent mis-process and reduce set-up time, a system that will help ensure that all qualified Die Attach recipes are properly stored and tamper-free should be in place. It is for this reason that the Die Attach Recipe Management System (DRMS) was developed so that all qualified recipes are stored in a more secure storage area that can only be accessed by certified technicians and engineers. The DRMS is a software application that is used to control the security and integrity of the saved recipes, ensuring correct and reliable recipes every download. The system offers the following features:

1. User restriction – The system can only be accessed by Engineers only. Operators and technicians are not allowed to retrieve recipes from the source.
2. Enforcing of parameter limits – The system can detect off-spec parameters and will immediately inform the user to correct the recipe.
3. History checking – All transactions are done through the system are recorded, so engineers can backtrack every download and upload made within a specified timeframe.
4. Barcoded Recipe search – The system can search the correct Die Attach recipe given the package thru barcode scanning of the transport lot number, and revision number supplied by the user instead of the user looking for it manually, which simplifies the retrieval process and reduces the opportunity for human errors.
5. Online Approval – The system will ask for the approval of Die Attach Engineers whenever a new recipe is uploaded. Qualification parameters are encoded before upload, which will be reviewed by the engineers. The uploaded recipe will not be available for downloading unless the engineers have approved the recipe.

In the DRMS, all Die Attach recipes are stored in a secured database server located in a remote location not readily accessible to the engineers. The users retrieve the recipes using a client application that is installed in the computer that is previously used for storing the Die Attach recipe. The client application will require the user to

identify himself before being able to download a recipe. The application retrieves the recipe via a Local Area Network (LAN) connection that connects the computer located in the Die Attach area to the database server. Fig. 2 shows how a Die Attach recipe is transferred with the DRMS in place.

In DRMS, three access levels can be assigned to the Engineer. However, access is given and approved by the DRMS Administrator from the IT department who can add and removing DRMS users. All users in DRMS have the capability to upload Die Attach recipes. To do so, users click the "Upload Recipe" button from the Main Menu. Once the upload Die Attach Recipe, users will select the machine name, enter the package name, and revision number that describes the Die Attach recipe. The DRMS will automatically search for a valid Die Attach recipe from the Die Attach machine [5-7].

There will be instances when a user will need to change some parameters to the Die Attach recipe once it has been used on the Die Attach machine. However, such changes will need to be
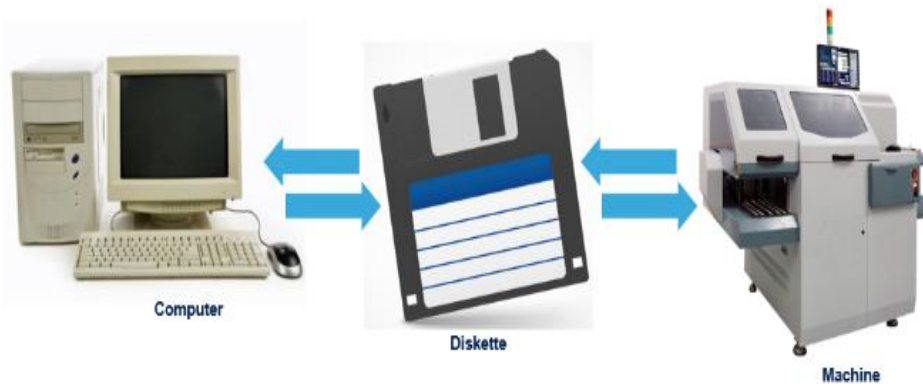

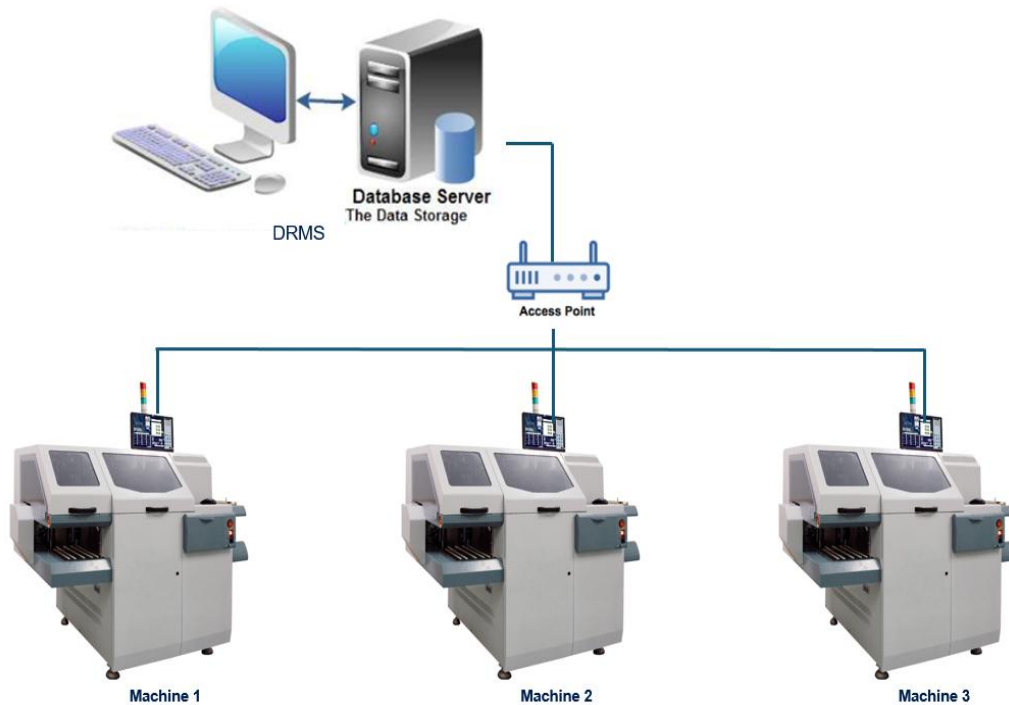**Fig. 1. Transferring die attach recipes between the computer and the die attach machine**

Fig. 2. Transferring die attach recipe using the die attach recipe management system.

known by DRMS to keep track of the changes made by the users. After a user downloads a Die Attach recipe, DRMS will keep a note of the recipe that has been downloaded. DRMS will show those changes and will tell the user that the system is going to record the changes. For the user to continue, he must allow DRMS to record those changes [8,9].

The DRMS offers higher confidence, security system for the Die Attach recipe. Although there are steps added to ensure the protection of the data, overall, it does not complicate the old procedure and still maintains the simplicity of the process. Below are the benefits that can be expected using the new system: First, the reduction of audit findings due to off-spec parameters. Second, the elimination of gross rejection due to the wrong recipe used. Third, faster recipe retrieval thus faster set-up time, and lastly higher repeatability and accuracy of the set-up. [10]

4. CONCLUSION

The DRMS is a more efficient way of controlling the Die Attach recipe. It ensures that all the saved recipes are updated and within specification thus giving higher chances of doing the set-up right the first time. The system offers four additional features from the old practice and offers less recipe recall time when compared to the old system. It has a defined automated procedure that the user will follow so it does not introduce complexity, unlike the old system which usually relies on the technician's judgment. The authors recommend the application of the same principle discussed in this paper to all processes be it Assembly or Test that has critical recipes to be controlled.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company   rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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