

An Automated Way of Baking Process for Moisture Sensitive Components

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ABSTRACT

The objective of my project is to the new technology termed as “baking process” to remove the moisture content available in the particular electronics devices which is used in Real time industrial application. In Industries there are certain policies are maintained for semiconductor devices, which referred as “Shelf life” of the material. Once it crossed its lifetime, some process need to done to extend this. Depends on the moisture sensitive characteristics baking is employed mainly to shelf life extension. The Baking is the process of removing of moisture content from particular semiconductor device in order to effective usage in the production line. In my propose method the moisture content is measured by corresponding moisture sensor. If it is normal level the processor goes to the normal state, If it reaches the abnormal level (presence of moisture) the processor baked the product. Temperature and humidity sensors are effectively monitor and provide the signal to the processor. The UTLP kit provide the information about the status of the product.

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1. INTRODUCTION

In Industries, the semiconductor material usage are purely based on the expiration date basis, if its crossed need to follow certain procedure depends on the moisture sensitive capacity and also need to automate these processes since there is some chances of mistakes in manual works. The Semiconductor devices are electronic components, they are exploit the electronic properties of semiconductor materials like silicon, germanium, and gallium arsenide, as well as organic semiconductors.

These semiconductor devices (Transistor, Diode, etc.) need to use within two years from its manufacturing period. Else it may loss its efficiency (good quality), so need to extend the life time by proper procedure, which is called Baking. Baking is the process need to remove the moisture content which is present in the device. There will be the maximum moisture absorption capacity for each semiconductor devices based on their Moisture Sensitive level (MSL). So the baking time regulated based on their maximum absorption capacity and current absorbed moisture. During baking process time is the important parameter, because even one or two hours of delay making some million revenue loss to the company which is happened sometime due to failure to meet the commitment to the end customer On Time delivery(OTD). OTD describes that meeting the commitment as promised earlier. Next one is the temperature, it needs to be maintained as desired depends on the part description.

2. LITERATURE SURVEY

[1] In some companies, the baking process followed based on the thickness of the part and using VFM (Variable Frequency method). There will be some fixed time based on the thickness of the electronic device which will lead to the excess time for baking than required. The electronics packaging market has a severe need for innovative approaches for moisture removal. Since it is mainly the moisture or water that causes problems, the ideal approach would be to target water molecules directly and couple energy into them for their removal.

[2] A method for estimation of moisture content in paper pulp is restricted to levels of moisture concentration below 90%. Some of the existing methods require less practical double-sided contact measurements. This paper presents a technique that uses fringing field inter digital sensors to measure moisture concentration in paper pulp at levels as high as 96%. The method proposed in this paper uses single-sided measurements, offers high sensitivity, and does not require special operating conditions.

[3] A measurement principle for online moisture determination of wood pellets that is based on capacitive sensing. To ensure reliability and proper operation of the sensing device even under harsh industrial conditions, a robust principle based on a frequency hopping approach is required. Therefore, we investigate the impact of multiple carrier frequencies and analyze the frequency dependency of the material permittivity.

[4] JEDEC and IPC Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need.

[5] The excess moisture in building structures may damage the structures and provide suitable conditions for microbe growth. As a consequence, moisture may cause different health effects to the occupants, and lead to costly refurbishments, if the damage is not perceived in time.

3. OVERVIEW OF BAKING PROCESS

The idea pertains generally to a mechanism for removing moisture content from the semiconductor devices. Below is the process flow which shows the scenarios when baking needed in Industries. General process in industries is once the part keyed in their system, IQA buy off will performed depends on the necessary. In industries there will be predefined the IQA status for all items whether it is needed or not. It's purely depends on manufacturer standard and about the part description. (1) If IQA needed then it will performed by concerned quality checking department. Then it will be performed by concern Quality department. If they reported the discrepancies like Date code expired (for MSL >2 items), MBB bag seal date expired else if bag damaged. For the discrepancies baking need to be preformed and then it will move to store. (ii) May be chances that using only partial quantities in production and kept it in store for later use. If in that case, there is some chances to get it expired in store while it is in store. In that case also we need to perform baking.

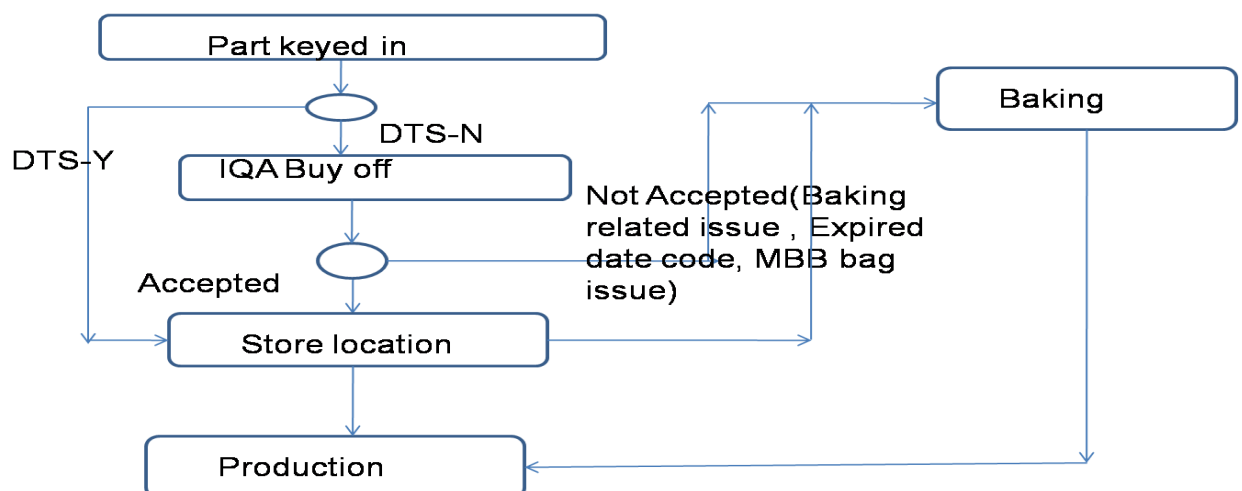


Figure 1. Overview of Baking process

In conventional method there will be excess time is needed for baking. Due to this power consumption also increased. It is the manual process so lead to human error sometimes like setting of incorrect time and temperature level which lead to the damage of the component. There is some chances that during the process might be temperature get varied due to the internal oven damage, these things also considered in our proposed system. Sometimes it is depends on the packaging type of also. For tape and reel packaging, Baking need to perform approximately at least 10 days. It will greatly increase the time of baking.

4. PROPOSED BAKING SYSTEM

In the proposed system, need to place the semiconductors which need to be baked in the oven. Once it get placed weight of the oven get increased based on that weight difference processor will trigger the oven. Next the moisture content in the device is measured, which will compared with the maximum moisture can be absorbed by the part (depends on the MSL Level). Based on this comparison determine the percentage of the moisture. There is some certain time limit to remove the maximum moisture in the device. By considering these data the time and temperature level set by the processor in the oven through the control unit. Then Baking is continued till it reached assigned time limit. During this process temperature in the oven measured through the separate temperature sensor, which will monitor and provide the temperature level to the processor. Once if any discrepancy then processor will terminate the process to avoid the damage to the component.

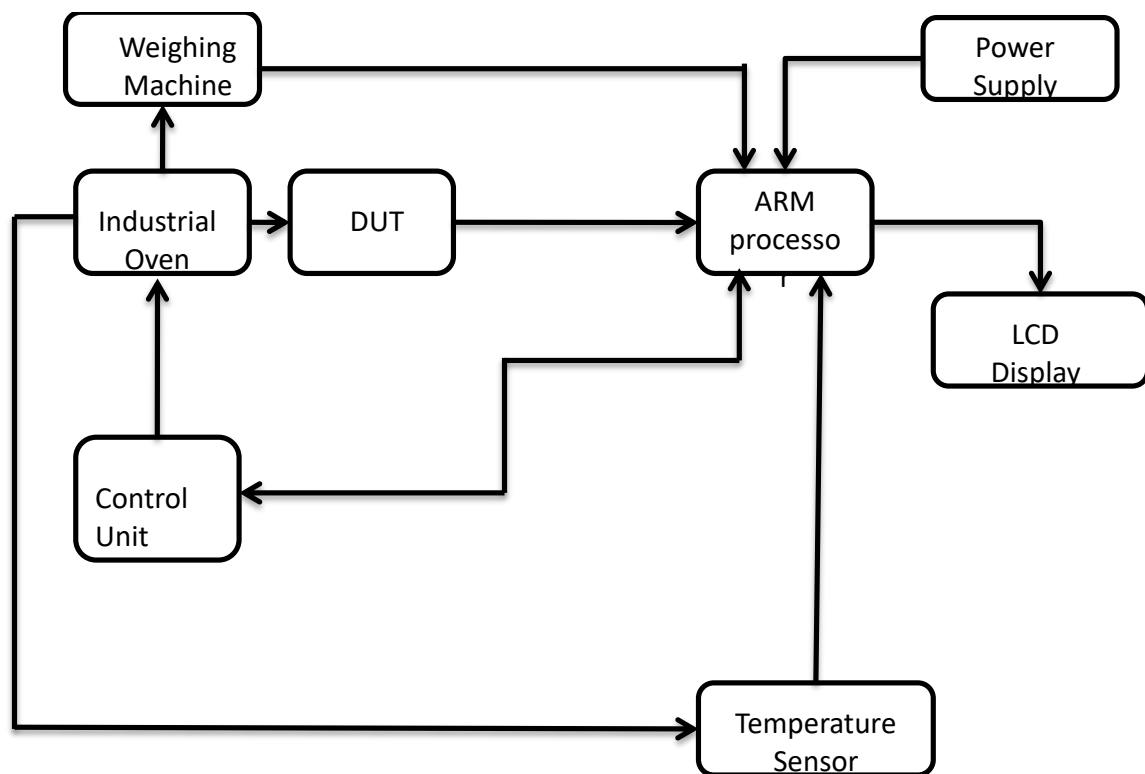


Figure 2. Block diagram of proposed system

4.1. Moisture Sensor

Thin film aluminum oxide moisture sensor is used in order to make it effective usage based on the moisture measurement.

Only aluminum oxide thin film sensor can be used for absolute humidity measurement. The sensor is basically a capacitor-like structure consisting of a bottom aluminum electrode, an anodized porous Al₂O₃ film, and a thin, water permeable gold top electrode.

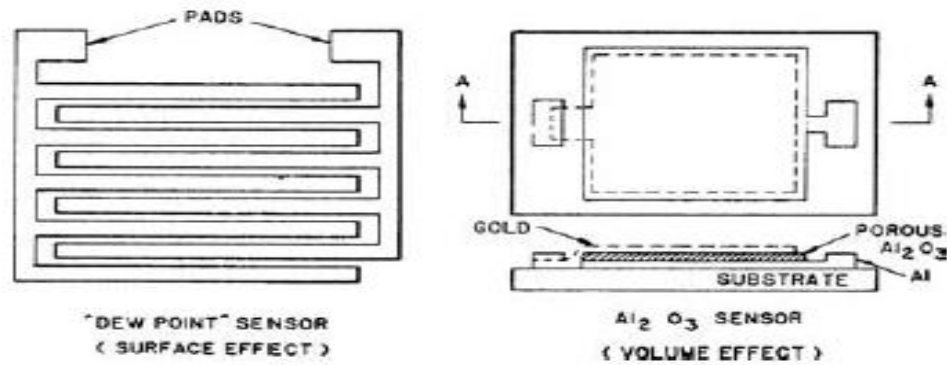


Figure 3. Moisture sensor

When water vapor is transported through the permeable gold layer and equilibrates on the pore walls, the number of water molecules absorbed on the pore determines the total complex impedance of the sensor. The “meter reading” is proportional to the admittance of the sensor. As the moisture level decreases, the admittance decreases. At a given pressure, there is a one to one correspondence between the dew/frost point and the parts per million of water vapor.

4.2. Industrial Oven

Industrial ovens are heated chambers used for a variety of industrial applications, including drying, curing, or baking components, parts or final products. Industrial ovens can be used for large or small volume applications, in batches or continuously with a conveyor line, and a variety of temperature ranges, sizes and configurations. Such ovens are used in many different applications, including chemical processing, food production, and even in the electronics industry, where circuit boards are run through a conveyor oven to attach surface mount components. The oven contains multiple zones, which can be individually controlled for temperature. Generally there are several heating zones followed by one or more cooling zones. The PCB moves through the oven on a conveyor belt, and is therefore subjected to a controlled time-temperature profile.

5. RESULTS

5.1. Theoretical Result

The theoretical result of the proposed baking process. Initially determine the percentage of the moisture availability, based on that the baking process also determined. If there is no moisture availability no need to perform baking.

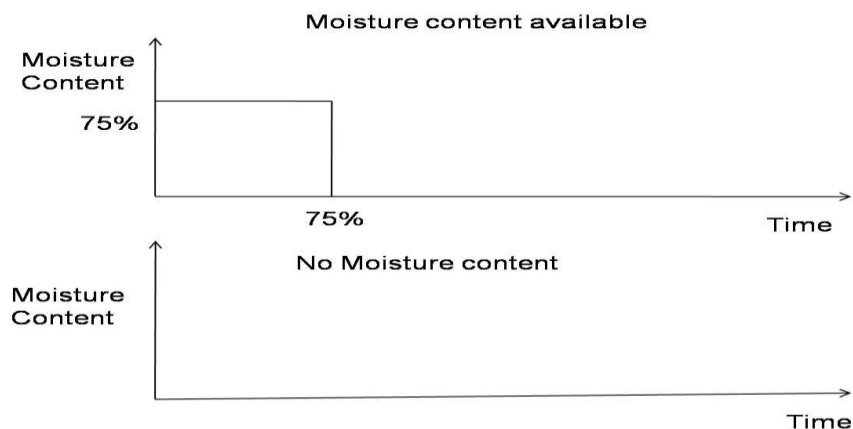


Figure 4. Theoretical result

5.2. Simulation Result

UTLP (Unified Technology Learning Platform) and Eclipse are used to simulate the problem domain. The UTLP have the advanced version of ARM 8 Processor which provide the status starting from the loading of item into oven till baking get over.

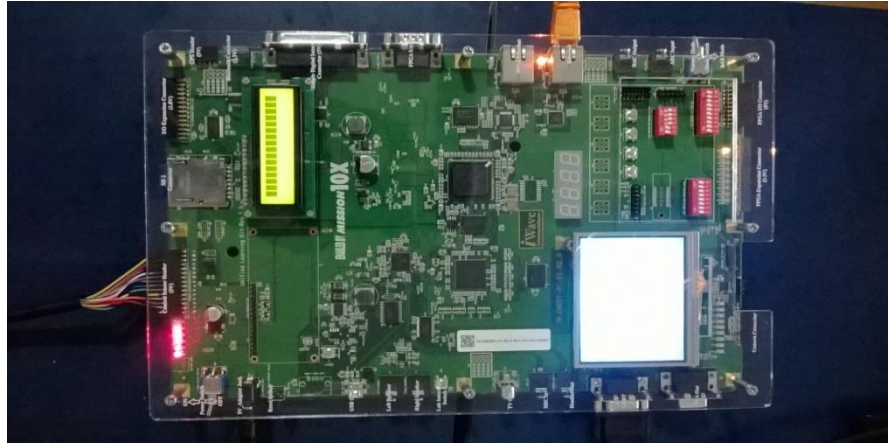


Figure 5. UTLP Project Kit

Once available moisture percentage is determined, System will inform us whether baking needed or not. If moisture not available then it will shows below message,



Figure 6. Baking status I

If any moisture content available then baking needed for this item so it show message as below and then it ensures baking process as follows.



Figure 7. Baking status II

Once processor confirmed that there will be some moisture and baking is needed. Then it shows the required baking time and temperature,



Figure 8. Baking Requirements

Once baking process is completed it will shows completion message as below,



Figure 9. Baking result

5.3. Discussion

Based on this proposal the time wastage can be effectively eliminated for the baking process. In conventional method, baking need to be performed even for moisture free component since that process does not depend on the moisture content availability. We are automated all the process which is starting from oven turn on to turn off which is also one of the reason for time reduction.

6. CONCLUSION

In proposed baking method all the process are automated which will reduce human errors and also required baking time also significantly reduced based on the moisture content availability. Power consumption reduced automatically since the baking time reduced. All these processes are ensuring smooth process flow in baking.

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