PROCESSOR MANUFACTURING AND APPLICATION

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Processors are used in all essential spheres of our everyday life. This device is present in almost every electronic device, in our computers and phones, in TVs and even in watches and some headphone models. Even though these units are so common people do not understand the complexity of the processor manufacturing process and the value of their appliance. Figure 1 presents two up-to-date processors models.

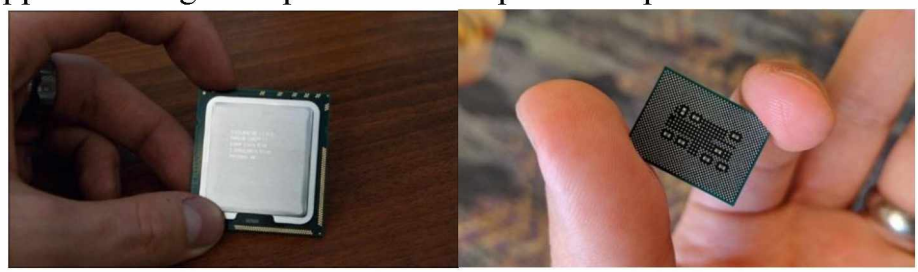

Figure1. Processors

To understand what a processor is and how complex it is we need to know about the primary component of each processor: the transistor. In brief, transistors are the switches, which either pass electrons from the emitter to the collector or do not allow electrons to flow. A system of several transistors forms a binary code which in turn forms the characters, sounds and images. In the first general-purpose computer, ENIAC, vacuum tubes were used as transistors. The number of tubes was numbered 17,5 thousand. That computer was able to make physical and mathematical calculations only. The first commercial processor, Intel 4004, manufactured in 1971, had 2250 transistors. Figure 2 demonstrates the difference in design and size between a vacuum tube and Intel 4004.

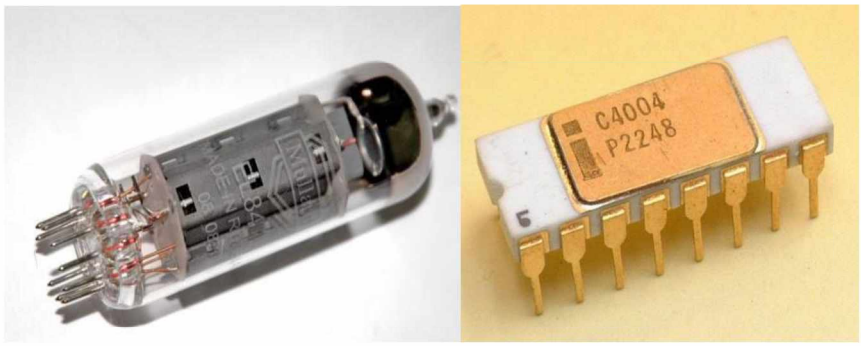

Figure 2. Vacuum tube and Intel 4004

Just after 7 years, Intel 8086 was introduced with 29 thousand transistors on its surface. Nowadays, an average computer has CPU with billions transistors.

The manufacturing process (shown in Figures 3 and 4) begins from cutting a pure silicon ingot in thin discs (Fig. 3.1). Each disc must be perfectly clean otherwise the entire batch will be rejected. The next step is transistor production. This long and difficult process begins from applying photoresist to the disc surface. Then the photoresist layer is being irradiated with light through a special template made of optic glass (Fig. 3.2). To secure some areas from subsequent treatment, the disc must be covered with an insulating covering (Fig. 3.3). After that, one more layer of

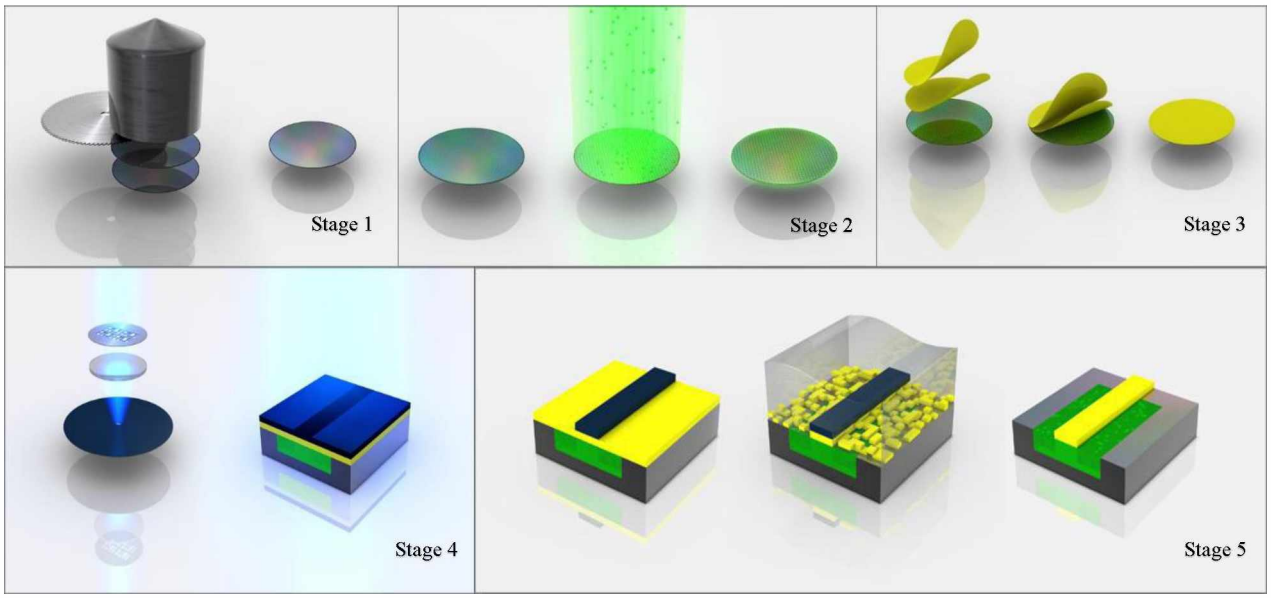

Figure 3. Stages 1-5 of the processor assembly process

photoresist is being applied and lithography is carried out (Fig. 3.4). All excess photoresist must be removed, in this case it is being done with a special chemical solute (Fig. 3.5). The residuary photoresist turns into a conductor.

The final stage is processor housing assemblage presented in Figure 4. Logic elements are being connected to each other and all the discs are sent to an assembly and testing manufactory where they undergo quality tests and are cut in single cores. The products only can be called processors when they are packed in a substrate and covered with a heat spreading cap.

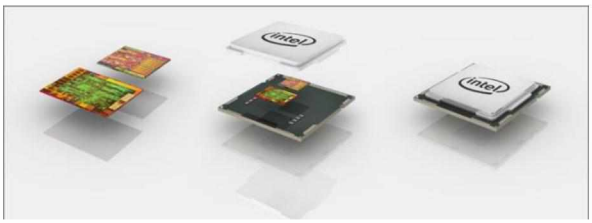

Figure 4. Processor housing assembly

Despite the fact that processor manufacturing is an even more complex process than it was described in this study and it has many intermediary steps which were not presented, the presented stages are major, and they give general explanation on the whole manufacturing and assembly process.

References

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