

## ***Conclusion and Future development***

The automatic assembly microfactory seems to be a very good approach to reduce the assembly cost of hybrid microproducts, to reach high precision and to achieve good ratio between products and assembly facilities resources consumption. Thus, it should allow a wide diffusion of hybrid microproducts and an extension of the benefits they own.

Two fundamental aspects have to be considered for the full development of assembly microfactories: the design of innovative handling devices and the capability to realize flexible and reconfigurable microfactories.

With regard to the first topic, microhandling is a key task within the microfactory. Because traditional systems are not suitable in the microdomain, the concept of innovative handling devices is an essential issue. Actually, new principles have to be exploited in order to realize efficient compact systems that overcome the difficulties of microhandling and fulfil the requirements of microassembly.

The handling devices developed within the PhD research activity are systems able to solve some microhandling issues: transporting and positioning, grasping and releasing, sorting. By exploiting principles relevant in the microdomain (such as the electrostatic) and suitable strategies, these devices permit to overcome adhesion forces and to handle parts of few hundreds microns. Furthermore, their compact size conception makes them suitable to be inserted in microfactories.

On the other hand, one of the main limits of the few microfactories developed till now is their quite rigid structure. Often microfactories are able to exploit only some assembly tasks, while many others have to be done manually. This conception is product oriented and immediately shows limits in case of low-medium production. In this sense, the flexible microfactory represents the future goal. This conception would permit to assemble different kinds of microproducts and would allow the quick and easy reconfiguration of the microfactory layout when the products significantly change.

In this sense, the microfactory developed within the PRIN project "Development of innovative technologies for the assembly of hybrid microproducts" represents an interesting approach to reconfigurable microfactory. The strategy, making use of a mobile carrier that moves from an assembly station to the next one, permits to limit the controls and to assemble different kinds of microproducts. Furthermore, the modular approach in terms of assembly stations allows the reconfiguration of stations in terms of DOF and end-effectors.