With technological progress, natural materials become insufficient to meet increasing demands on product capabilities and functions. There are many combinations of metallic and non-metallic atoms that can combine to form ceramic components, and also several structural arrangements are usually possible for each combination of atoms. This led scientists to invent many new ceramic materials to meet increasing requirements and demands in various application areas. The technology of ceramics is a rapidly developing applied science in today's world. Technological advances result from unexpected material discoveries. On the other hand, the new technology can drive the development of new ceramics. Currently many new classes of materials have been devised to satisfy various new applications. Advanced ceramics offer numerous enhancements in performance, durability, reliability, hardness, high mechanical strength at high temperature, stiffness, low density, optical conductivity, electrical insulation and conductivity, thermal insulation and conductivity, radiation resistance, and so on. Ceramic technologies have been widely used for aircraft and aerospace applications, wear-resistant parts, bioceramics, cutting tools, advanced optics, superconductivity, nuclear reactors, etc. Ceramics application could be categorised as structural ceramics, electrical ceramics, ceramic composites, and ceramic coatings. These materials are emerging as the leading class of materials needed to be improved to explore further potential applications. As advances in ceramic technology offer potential and immediate opportunities, these materials will translate into greater market shares in transportation sectors. On the other hand, future application is still very limited if no breakthroughs are achieved in fundamental and applied research: Silicon Carbide (SiC) seems to be a good candidate. Research and development on SiC-based advanced ceramics and composites has attracted a great deal of attention in recent years. The potential applications of these materials include components for advanced propulsion systems, energy conversion devices, and other high-temperature structures. For these applications, the fabrication processes for the SiC-based ceramics should yield materials which generally display high strength, high toughness, and high termal conductivity and maintain these properties under oxidizing conditions. In addition, there are other critical issues in the fabrication of silicon carbide based ceramics which are mainly related to complex shape fabricability, processing time, and temperatures. A combination of these factors leads to higher manufacturing cost of the final components. Owing to the above considerations, there is a strong need to develop processing approaches for SiC-based advanced ceramics, which yield high strength and toughness, high thermal conductivity, good oxidation resistance, and cost effectiveness. In terms of achieving SiC ceramics with desirable properties, the reaction-forming process has many advantages over other conventional silicon carbide processing techniques. This process has near-net-shape and complex shape fabrication capabilities, shorter processing times, and lower processing temperatures than other conventional processes. In this technique, a microporous carbon preform is infiltrated with molten silicon or silicon-refractory metal alloys. These molten infiltrants react with carbon to form silicon carbide or silicon carbide and refractory disilicide phases. The structure and physical properties (pore size and volume, densities etc.) of the microporous carbon preform can be controlled to yield tailored microstructures, compositions, and properties of the final material. The main goal of the research activity here proposed is to optimize the RBSC in order to obtain finally hybrid composites (SiC-Silicide-Si) with a tailored-microstructure. It will be obtained by defining several mini-goals or objectives (tasks): a) preliminary investigation of suitable container materials and atmosphere for Si-alloys melts at high temperatures; b) dynamic measurements by container-less method of the thermophysical properties mainly controlling the infiltration processess, i.e. surface tension and density of the selected Si-X alloys as infiltrants materials; c) study of reactivity and interaction phenomena (wetting characteristics and spreading kinetics) between molten Si-alloys and C-materials; d) dynamic infiltration experiments of selected Si-alloys and C-based materials preforms; e) microstructural characterization of the hybrid composites (SiC-SiMe siliced-Si) obtained by non-destructive analysis by 2D- and 3D- imaging using computed tomography (CT) techniques and conventional destructive methods of materials characterization such as scanning electron microscopy (SEM) coupled with local chemical analysis (EDS, EBSD) in order to estimate post-mortem one of the more representative parameter for infitrated materials, the infiltration height vs time, etc. The "degree of efficiency" of the process, strickly correlated to the quality of the final product, will be determined by the final microstructure, in particular by the ratio unreacted silicon/silicide and by the height of infiltration mainly negatively controlled by the ratio thickening of SiC/porosity at the reaction front (pore closure phenomenon). It will be done by 3D-CT-imaging of the intire structure of the infiltrated and reacted carbon preforms at different length scales (macro, micro and nano). The "degree of efficiency" above introduced sharply discriminates the final composite obtained as "performant" or "not-performant".