There is currently a tremendous effort in the automobile industry to reduce the overall mass of vehicles so as to increase their efficiency. Reducing the weight of vehicles will directly increase fuel efficiency. The National Academy of Science has reported that a 10% decrease in vehicle mass could increase their efficiency by 6-8% per full tank. Furthermore, a decrease in weight would greatly benefit future developments in hybrid and electrical vehicles, increasing their distance per charge ratio (i.e. autonomy). This factor would certainly improve their commercialization. The United States Automotive Materials Partnership (USAMP) is aiming to substitute 630 pounds of iron and aluminum components by 340 pounds of magnesium components before 2020. This important reduction of 290 pounds (47% of reduction) would result in a 31% fuel economy for common propulsion systems. These automobile components include engine cradles, under body brackets, clutch and brake pedal brackets, transmission cases, covers, housings, extensions, and pistons.

Magnesium (Mg) represents the lightest metal commercially available. Its ideal mechanical properties could be employed to modify and improve standards alloys used in automobiles components. This mixture would allow an important decrease in vehicle weight, increasing at the same time their autonomies. However, the use of Mg is highly limited due to its corroding properties. It is highly corrosive in part due to its position in the galvanic series. When joined with other materials such as steel or aluminum, galvanic corrosion sets in caused by electrical contact and electron transport. Galvanic corrosion of Mg poses a serious impediment and slows down its industrial applications.

Various methods are industrially employed in order to fabricate corrosion resistant alloys using different cooling times, mold nature/geometry and post treatments. By using different casting methods, it is possible to vary microstructure distribution and size along to alloying elements distribution across the surface enhancing their corrosion resistance. Since Mg corrosion remains a very active system, the electrochemical processes occurring in situ are of great interest to further study the corrosion mechanism. As the corrosion of Mg alloys occurs on the micron and submicron level, Scanning Electrochemical Microscopy (SECM) represents the appropriate alternative to assess the Mg corrosion in situ.