corresponding electro-dip coating bath is very complicated and expensive to construct, not to mention all the electrical and mechanical equipment, from temperature control, power supply and electrical insulation, circulating equipment and feed equipment to disposal of the anolyte acid, which is formed in electrolytic coating and also ultrafiltration, to paint recycling as well as the control equipment. The process management also requires a very high technical expenditure because of the high amperage and high energy consumption as well as in equalizing the electrical parameters over the bath volume and in precise adjustment of all process parameters as well as in maintenance and cleaning of the installation.

The known autophoretic methods are based on a currentless concept, consisting of a pickling attack on the substrate surface used, in which metal ions are dissolved out of the surface and the emulsion coagulates because of the concentration of metal ions at the resulting interface. Although these methods do not have the aforementioned restriction of the electrolytic methods with regard to the Faraday cage effect, the coatings formed in this process must be fixed in a complex multistage immersion process after the first activation step. In addition, the pickling attacks results in an unavoidable contamination of the active zone with metal ions that must be removed from the zones. Furthermore this method is based on a chemical deposition process which is not self-regulating and cannot be terminated on demand such as, for example, by shutting down the electric current in the electrolytic method. Thus with a longer dwell time of the metallic substrates in the active zones, the development of an excessively great layer thickness is unavoidable.

A wish that has long been pursued is to form homogenous coatings efficiently and inexpensively in an immersion process to produce essentially planar coatings that have the greatest possible thickness and are as closed as possible.

Therefore the object is to propose a method with which a paint formulation can be deposited on metallic surfaces homogenously, with good coverage and by a simple method, using a liquid system, which is also rinse-resistant if necessary. Another object was to propose the simplest possible method of accomplishing this.

In an aspect, there is provided a method for coating metal surfaces of substrates comprising or consisting of the steps:

I. Providing a substrate with a purified metal surface,

II. Contacting and coating metal surfaces with an aqueous composition in the form of a dispersion and/or suspension,

III. Optionally rinsing the organic coating and

IV. Drying and/or baking the organic coating or

V. Optionally drying the organic coating and applying a similar or additional coating composition as a coating prior to drying and/or baking,

characterized in that, in step II, the coating is applied in the form of an aqueous composition as a dispersion and/or suspension containing a complex fluoride, selected from the group consisting of hexa- or tetrafluorides of the elements titanium, zirconium, hafnium, silicon, aluminum and/or boron in an amount of $1.1 \cdot 10^{-6}$ mol/liter to 0.30 mol/liter, based on the cations, wherein at least one nonionic or anionic-nonionic polyelectrolyte is added in an amount of 0.01 to 5.0% by weight, based on the total weight of the resulting mixture, is added to the nonionically or anionically-nonionically stabilized dispersion of film-forming polymers and/or a suspension of film-forming inorganic particles with a solids content of 2 to 40% by weight and an average particle size of 10 to 1000 nm, which is stable in a pH range of 0.5 to 7.0, wherein the aqueous composition has a pH in the range of 0.5 to 7.0 and forms a coating based on an ionogenic gel, which binds cations dissolved out of the metallic surface and these cations originate from a pretreatment step and/or from the contacting in step II.

In another aspect, there is provided an aqueous composition containing in an anionically stabilized dispersion of film-forming polymers and/or a suspension of film-forming inorganic particles with a solids content of 2 to 40% by weight and an average particle size of 10 to 1000 nm, which is stable in the pH range of 0.5 to 7.0, at least one polyelectrolyte in an amount of 0.01 to 5.0% by weight, based on the total amount of the resulting mixture as well as a complex fluoride selected from the group consisting of hexafluorides or tetrafluorides of the elements titanium, zirconium, hafnium, silicon, aluminum and/or boron in an amount of $1.1 \cdot 10^{-6}$ mol/liter to 0.30 mol/liter, based on the cations, wherein the aqueous composition has a pH in the range of 4 to 11.

In another aspect, there is provided a use of the method as defined above, for coating substrates, which have already caused problems in coating by electro-dip coating.

This object is achieved with a method for coating metal surfaces of substrates comprising or consisting of the steps:

I. Providing a substrate with a cleaned metallic surface,