Claims

1. Process for reactive stripping of carbon layers from a substrate, particularly for the reactive removal of ta-C coatings from the surface of parts and tools, in which the substrate to be de-coated is placed on a substrate holder in a vacuum chamber, the vacuum chamber is charged with at least one reactive gas supporting the stripping of carbon in gaseous form, and a plasma discharge is initiated in the vacuum chamber to support the necessary chemical reaction or reactions to strip the coated substrate, and the de-coating proceeds in one step or a number of steps, unique in that the plasma discharge is produced as a low voltage direct current arc discharge, with discharge currents between 20 A and 1000 A, preferably between 50 A and 300 A, with discharge voltage of at most 120 V, preferably between 20 V and 80 V.

2. Process according to claim 1, **unique in that** the substrate is connected as the anode for the low voltage direct current arc discharge, and thereby the substrate surface is bombarded essentially exclusively with electrons, which due to their low mass exclude any sputtering.

3. Process according to claim 1, unique in that the substrate is brought into the low voltage direct current arc discharge in insulated state, so that the ions impinging on the substrate have energies essentially under 20 eV, and therefore below the sputter threshold.

4. Process according to claim 1, unique in that for the low voltage direct current arc discharge, an electrode differing from the substrate holder and the chamber wall is used as the anode, and the substrate is maintained at floating potential.

5. Process according to one of the foregoing claims, **unique in that** to remove at least a portion of the carbon coating from the substrate during at least one step of the reactive de-coating, preferably during the last step of the reactive de-coating, a gas containing nitrogen is used as the reactive gas, and preferably the nitrogen-containing reactive gas used consists predominantly of nitrogen gas, and especially preferably the nitrogen-containing reactive gas used consists essentially entirely of nitrogen.

6. Process according to one of the foregoing claims, **unique in that** to remove at least a portion of the carbon coating from the substrate during at least one step of the reactive de-coating, but not during the last step of the reactive de-coating, and preferably during the first step of the reactive de-coating, a gas containing oxygen is used as the reactive gas, and preferably the oxygen-containing reactive gas used consists predominantly of oxygen gas, and especially preferably the oxygen-containing reactive gas used consists essentially entirely of oxygen.

7. Process according to claim 6, **unique in that** the flow of oxygen-containing reactive gas is terminated before the carbon layer is completely removed at any part of the substrate by the reaction with oxygen, so that it is prevented that any de-coated substrate surface begins to be oxidized by reaction with the oxygen.

8. Process according to claim 7, **unique in that** after the flow of oxygen-containing reactive gas is terminated, hydrogen gas is introduced into the stripping chamber, so that the oxygen component in the coating and the undesirable residue of oxygen in the substrate surface are reduced.

9. Process for reactive de-coating of carbon layers from a substrate, particularly for the reactive removal of ta-C coatings from the surface of parts and tools, in which the substrate to be de-coated is placed on a substrate holder in a vacuum chamber, the vacuum chamber is charged with at least one reactive gas supporting the stripping of carbon in gaseous form, and a plasma discharge is initiated in the vacuum chamber to support the necessary chemical reaction or reactions to strip the coated substrate, and the de-coating proceeds in one step or a number of steps, unique in that in order to remove at leas a portion of the carbon layer from the substrate, in at least the last step of the reactive de-coating, a gas is used which includes nitrogen as the reactive gas.

10. Process according to claim 9, **unique in that** the nitrogen-containing reactive gas used consists predominantly of nitrogen gas, preferably essentially entirely of nitrogen.

11. Application of a process according to one of the foregoing claims for the stripping of substrates coated with carbon layers, whereby the carbon layers contain in addition to carbon other non-metallic elements, particularly hydrogen (H), boron (B), silicon (Si) and/or germanium (Ge).

Claims

1. Process for reactive de-coating of carbon layers from a substrate, particularly for the reactive removal of ta-C coatings from the surface of parts and tools, in which the substrate to be de-coated is placed on a substrate holder in a vacuum chamber, the vacuum chamber is charged with at least one reactive gas supporting the stripping of carbon in gaseous form, and a plasma discharge is initiated in the vacuum chamber to support the necessary chemical reaction or reactions to strip the coated substrate, and the de-coating proceeds in one step or a number of steps, **unique in that** the plasma discharge is produced as a low voltage direct current arc discharge, with discharge currents between 20 A and 1000 A, preferably between 50 A and 300 A, with discharge voltage of at most 120 V, preferably between 20 V and 80 V, and to remove at least a portion of the carbon coating from the substrate, during at least one step of the reactive stripping, a gas containing nitrogen is used as the reactive gas, and especially preferably, the reactive gas used consists predominantly of nitrogen.

2. Process according to claim 1, **unique in that** the substrate is connected as the anode for the low voltage direct current arc discharge, and thereby the substrate surface is bombarded essentially exclusively with electrons, which due to their low mass exclude any sputtering.

3. Process according to claim 1, unique in that the substrate is brought into the low voltage direct current arc discharge in insulated state, so that the ions impinging on the substrate have energies essentially under 20 eV, and therefore below the sputter threshold.

4. Process according to claim 1, unique in that for the low voltage direct current arc discharge, an electrode differing from the substrate holder and the chamber wall is used as the anode, and the substrate is maintained at floating potential.

5. Process according to one of the foregoing claims, **unique in that** to remove at least a portion of the carbon coating from the substrate during at least one step of the reactive de-coating, but not during the last step of the reactive de-coating, and preferably during the first step of the reactive de-coating, a gas containing oxygen is used as the reactive gas, and preferably the oxygen-containing reactive gas used consists predominantly of oxygen gas, and especially preferably the oxygen-containing reactive gas used consists essentially entirely of oxygen.

6. Process according to claim 5, **unique in that** the flow of oxygen-containing reactive gas is terminated before the carbon layer is completely removed at any part of the substrate by the reaction with oxygen, so that it is prevented that any de-coated substrate surface begins to be oxidized by reaction with the oxygen.

7. Process according to claim 6, **unique in that** after the flow of oxygen-containing reactive gas is terminated, hydrogen gas is introduced into the stripping chamber, so that the oxygen component in the coating and the undesirable residue of oxygen in the substrate surface are reduced.

8. Application of a process according to one of the foregoing claims for the stripping of substrates coated with carbon layers, whereby the carbon layers contain in addition to carbon other non-metallic elements, particularly hydrogen (H), boron (B), silicon (Si) and/or germanium (Ge).