

The wafer was then placed in a solution of 30 mg of the polystyrene sulphate (9) described and 10 ml of H₂O and treated therein at room temperature for 20 minutes. The wafer was then treated three times in 10 ml of H₂O at room temperature again for 20 seconds each time. The polymer multilayer was constructed by continuing this process in the manner described in Example 11.

EXAMPLE 13

Preparation of an alternating multilayer comprising a monomolecular di-anion and the polymer ammonium salt described in the above scheme on the monomolecular and polymer interlayer according to FIG. 5 and FIG. 8

The support was prepurified and silanised, such as was described in detail in Example 8. The supports were then treated to give the stable charged surface according to Example 9 and Example 10.

The wafer was first placed in a solution of 30 mg of the polymer ammonium salt (8) described in the above reaction scheme and 10 ml of H₂O and treated therein at room temperature for 20 minutes. The wafer was then washed in 10 ml of H₂O at room temperature three times for 20 seconds each time. The wafer was then placed in a solution of 4 to 5 mg of (5), 2 ml of H₂O and 8 ml of DMSO and treated therein at room temperature for 20 minutes. The wafer was then first treated in ice-cold H₂O and twice in H₂O at room temperature for 20 seconds each time.

The alternating multilayer was constructed by continuing this process in the manner described in Example 11 and Example 12.

EXAMPLE 14

Preparation of ϵ -biotinylated poly-1-lysine (compound 8)

Compound 8 was prepared by reaction of poly-1-lysine (SERVA, Mn=50,000-100,000) with the activated biotin active ester (biotin N-hydroxysuccinimide=BNHS). 50 mg (0.5 mmol) of poly-1-lysine and 30 mg (0.5 mmol) of triethylamine were initially introduced into a 100 ml flask and dissolved in 30 ml of methanol. 40 mg (0.024 mmol) of BNHS, dissolved in 10 ml of CHCl₃/isopropanol (1:1), were then slowly added dropwise to the reaction mixture, which was then heated to reflux for one hour with stirring and then stirred at room temperature overnight. The resulting yellowish precipitate was isolated by filtration. It was suspended in 30 ml of methanol, stirred under reflux for 20 minutes, and again cooled to room temperature. The solid was again separated off by filtration and washed in portions three times with 20 ml of methanol each time, again suspended in 10 ml of CHCl₃/isopropanol (1:1), again stirred under reflux for 20 minutes and again cooled to room temperature. After filtering, the solid was washed in portions three times with 20 ml of CHCl₃/isopropanol (1:1) each time. The residue thus isolated was dried under an oil pump vacuum, dissolved in a small amount of distilled water and freed from low-molecular-weight by-products by gel permeation chromatography. The pure colourless copolymer was obtained from an aqueous solution by freeze drying. The yield was 25% of theory. The biotinylated poly-1-lysine was characterised by IR and NMR spectroscopy. According to ¹H NMR, the composition of the copoly-

mer (1-lysine/N_ε-biotinyllysine) is 1:1 (formulae shown in FIG. 9).

EXAMPLE 15

Preparation of a physisorbed multilayer having a poly-1-lysine topcoat

The support was prepurified and silanised, as described in detail in Example 8. The support was then provided according to Example 9 with a negative surface by adsorption of the low-molecular-weight dianion.

The wafer was treated at room temperature with a solution of 2 mg of poly-1-lysine in a mixture of 2.8 ml of H₂O and 0.2 ml of 0.1 N HCl for 20 minutes. The wafer was then washed three times in 10 ml of H₂O at room temperature for one minute each time (diagram in FIG. 10, upper picture).

EXAMPLE 16

Preparation of a physisorbed multilayer having a topcoat comprising biotinylated poly-1-lysine (compound 8)

The support was prepurified and silanised, as described in detail in Example 8. The support was then provided according to Example 9 with a negative surface by adsorption of the low-molecular-weight dianion.

The wafer was treated at room temperature with a solution of 2.3 mg of the biotinylated poly-1-lysine prepared in Example 14 in a mixture of 2.8 ml of H₂O and 0.2 ml of 0.1 N HCl for 20 minutes. The wafer was then washed three times in 10 ml of H₂O at room temperature for one minute each time (diagram in FIG. 10, lower picture).

EXAMPLE 17

Biospecific recognition reaction of a biotinylated support surface in comparison with a non-biotinylated support surface by means of fluorescence-labelled streptavidin

The multilayer systems prepared in Example 15 and Example 16 were dipped simultaneously into a solution of 0.02 mg of streptavidin labelled with fluorescein isothiocyanate in 4.0 ml of 0.15 M NaCl solution at room temperature. After 20 minutes, both supports were washed three times in 10 ml of H₂O at room temperature for one minute each time and then analysed by fluorescence microscopy and spectroscopy. The support prepared in Example 15 having a surface comprising pure poly-1-lysine showed very little fluorescence under the fluorescence microscope, which was due to a few adsorbed fluorescent particles. The support prepared in Example 16 having a surface comprising biotinylated poly-1-lysine showed an evenly distributed very intensive fluorescence under the fluorescence microscope (diagram in FIG. 11). The relative fluorescence intensity at the fluorescence maximum found for the support from Example 16 by fluorescence spectroscopy was 100 scale divisions. The support from Example 15 showed a relative fluorescence intensity of 8 scale divisions.

The fluorescence spectrum for Example 17 is shown in FIG. 12.

What is claimed is:

1. A layer element applied to a support, comprising: