Patent claims

1. A dosing system (1) for a dosing material having a nozzle (40), a feed channel (44) for the dosing material, a discharge element (31), an actuator unit (10) that is coupled to the discharge element (31) and/or the nozzle (40) and has a piezo actuator (60), and a cooling device (2), the cooling device (2) comprising a supply device (21, 24, 26) for feeding a precooled cooling medium into a housing (11) of the dosing system (1), the cooling device (2) being configured for direct cooling by means of the precooled cooling medium of at least one subregion of the piezo actuator (60) and/or at least one subregion of a movement mechanism (14) coupled to the piezo actuator (60).

2. The dosing system according to claim 1, wherein the piezo actuator (60) comprises an actuator housing (62) in which piezo elements (67) are encapsulated.

3. The dosing system according to any one of claims 1 or 2, wherein the cooling device (2) is configured to control and/or to regulate the cooling of at least one subregion of the piezo actuator (60) and/or at least one subregion of the movement mechanism (14) coupled to the piezo actuator (60) as a function of at least one state parameter.

4. The dosing system according to claim 3, wherein the at least one state parameter is a temperature in at least one subregion of the piezo actuator (60) and/or a temperature in at least one subregion of the movement mechanism (14) coupled to the piezo actuator (60).

5. The dosing system for a dosing material having a nozzle (40), a feed channel (44) for the dosing material, a discharge element (31), an actuator unit (10) that is coupled to the discharge element (31) and/or the nozzle (40) and has a piezo actuator (60), and a cooling device (2) which is configured to cool at least one subregion of the piezo actuator (60) and/or at least one subregion of a movement mechanism (14) coupled to the piezo actuator (60) in a controlled and/or regulated manner as a function of at least one state parameter, particularly according to claim 3 or 4, wherein the at least one state parameter is a length of at least one subregion of the piezo actuator (60) and/or a distance between the discharge element (31) and the nozzle (40) of the dosing system (1) and/or a dosing amount.

6. The dosing system according to claim 3 or 4, wherein the at least one state parameter is a length of at least one subregion of the piezo actuator (60) and/or a distance between

the discharge element (31) and the nozzle (40) of the dosing system (1) and/or a dosing amount.

~~6. The dosing system according to any one of the preceding claims 3 to 5, wherein the dosing system (1) comprises a temperature sensor (52, 78) and/or a strain sensor (87) and/or a movement sensor (53) for determining the state parameter.~~

~~7. The dosing system according to any one of the preceding claims, wherein the cooling device (2) is configured to control and/or regulate the cooling of at least one subregion of the piezo actuator (60) separately, particularly separately from the control and/or regulation of the cooling of at least one subregion of the movement mechanism (14) coupled to the piezo actuator (60).~~

~~8~~7. The dosing system according to any one of the preceding claims 1 to 4 or 6, wherein the precooled cooling medium is configured to cool at least one subregion of the piezo actuator (60) and/or at least one subregion of the movement mechanism (14) coupled to the piezo actuator (60) to a target temperature.

~~9~~8. The dosing system according to any one of the preceding claims 1 to 4 or 6 to 7, wherein the cooling device (2) for cooling the cooling medium comprises at least one cold generating device (55, 57).

~~6~~9. The dosing system according to any one of the preceding claims 3 to ~~5~~8, wherein the dosing system (1) comprises a temperature sensor (52, 78) and/or a strain sensor (87) and/or a movement sensor (53) for determining the state parameter.

~~7~~10. The dosing system according to any one of the preceding claims, wherein the cooling device (2) is configured to control and/or regulate the cooling of at least one subregion of the piezo actuator (60) separately, particularly separately from the control and/or regulation of the cooling of at least one subregion of the movement mechanism (14) coupled to the piezo actuator (60).

~~10~~11. The dosing system according to claim ~~9~~8, wherein the cold generating device (55) is configured to cool the cooling medium to a predeterminable temperature.

~~11~~12. The dosing system according to claim ~~9~~ 8 or ~~10~~11, wherein the cold generating device (55, 57) comprises a vortex tube (57) and wherein the vortex tube (57) preferably comprises an adjustable valve (94) for regulating the temperature of the cooling medium.

~~12~~13. The dosing system according to any one of the preceding claims, wherein at least one subregion of the movement mechanism (14) coupled to the piezo actuator (60) comprises a heating device (51) for heating at least one subregion of the movement mechanism (14) coupled to the piezo actuator (60).

~~13~~14. The dosing system according to claim ~~12~~13, wherein the heating device (51) is configured to keep at least one of the following state parameters constant in cooperation with the cooling device (2) of the dosing system (1):
- a temperature in at least one subregion of the piezo actuator (60) and/or in at least one subregion of the movement mechanism (14) coupled to the piezo actuator (60)
- a length of at least one subregion of the piezo actuator (60)
- a distance between the discharge element (31) and the nozzle (40)
- a dosing amount of the dosing material.

~~14~~15. A method for operating a dosing system (1) for the dosing of dosing material, the dosing system (1) comprising a nozzle (40), a feed channel (44) for the dosing material, a discharge element (31), an actuator unit (10) that is coupled to the discharge element (31) and/or the nozzle (40) and has a piezo actuator (60), and a cooling device (2), a housing (11) of the dosing system (1) being fed a precooled cooling medium by means of a supply device (21, 24, 26) of the cooling device (2), and at least one subregion of the piezo actuator (60) and/or at least one subregion of a movement mechanism (14) coupled to the piezo actuator (60) being cooled directly by the cooling device (2) by means of the precooled cooling medium.

~~15~~16. A method for manufacturing a dosing system (1) for the dosing of dosing material having an actuator unit (10) having a piezo actuator (60), the dosing system (1) being equipped with a cooling device (2), the cooling device (2) being equipped with a supply device (21, 24, 26) for feeding a precooled cooling medium into a housing (11) of the dosing system (1), and the dosing system (1), particularly the cooling device (2), being configured so that at least one subregion of the piezo actuator (60) and/or at least one subregion of a movement mechanism (14) coupled to the piezo actuator (60) is cooled directly by means of the precooled cooling medium.