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D007 Forbidden material list SEM tender: 0023 FPL/INK 29

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1 Introduction

1.1 Vacuum exposed areas

1.1.1 Forbidden materials

For this class of materials standard UHV compatible materials are the baseline of allowable materials. The following materials (material classes) are forbidden for vacuum exposed parts:

General:

All materials, coatings and platings containing over 0.03 wt% of Cd, Sn, Tl, Te, Sr, Yb, S, Hg, Zn, Sn, Ga, As, In, Pb, Bi. Unless they are protected by another impermeable coating.

Material:

- › Any metal with a vapour pressure $>1\text{e-}6$ mbar at 200°C
- › Cast metals including aluminium, copper iron and steel
- › Anodized aluminium

Silicon compounds, siloxanes

These materials are often used in seals and show a high emission of siloxanes. Furthermore they are used in some oils and greases.

Plastics

Plastics are forbidden except for those mentioned in the accepted material list

Hydrocarbons with carbonyl functionalities

A typical example is 1-oxo-decane (decanal) with a boiling point at 207 °C as well as MMA (methyl metacrylate, which is an outgassing material of e.g. Perspex; MMA and can be replaced by polycarbonates). A cleaning of these compounds with standard methods is not possible.

Lubricants based on MoS₂ und WS₂

The use of dry lubricants may cause the danger of particle release.

Colours and varnishes

The use of colours and varnishes is prohibited.

1.1.2 Restricted materials

The usage of these materials should be avoided for as far as possible. If the material is to be used acceptance by TNO is mandatory.

Metals:

Materials containing Sn, Si, Ag can only be used if no particles are generated during the usage to avoid cross contamination towards EUV/H* exposed areas

Aliphatic hydrocarbons

Sources for these materials are solvents and detergents as well as outgassing compounds of other materials. The concentration of these materials is a critical item insofar, that the cleaning times for the optics increases with rising concentration.

Aromatic hydrocarbons

Typical examples for aromatic hydrocarbons are toluene and xylene. They are critical for the same reasons as aliphatic hydrocarbons.

Plastics

Plastics have to be tested concerning their outgassing behaviour as well as the outgassing materials. Depending on the method of manufacturing a permanent high outgassing is possible. It has to be checked, if a bake-out process previous to the use of the desired plastic leads to a reduction of the outgassing rate. Generally only known vacuum engineering plastics are allowed. Plastics containing phthalates or other softeners are completely forbidden.

Seals

Seals have to be free of silicones (no detectable outgassing).

It has to be kept in mind, that there is a high variety of viton seals available, which have different outgassing rates and amounts of silicones. The desired seal type has

to be thoroughly checked upon its outgassing rate and its use has to be discussed with TNO first.

Glues, adhesives

Glues and adhesives based on siloxanes are forbidden materials.

Other glue materials (epoxy, cyano-acrylate, phenole resin) have to be checked upon their outgassing rate and the outgassing compounds. Every desired material has to be checked thoroughly and its use has to be discussed with the respective coordinator at TNO.

Greases, lubricants and oils based on PTFE

Lubricants, oils and greases, which contain PTFE are generally only accepted in a UHV version. Outgassing data needs to be provided to TNO before acceptance by TNO.

Acceptable greases are stated in the accepted materials list.

1.2 Clean room exposed areas

1.2.1 Forbidden materials

For this class of materials standard clean room compatible materials are the baseline of allowable materials. The following materials (material classes) are forbidden for cleanroom exposed parts:

Silicon compounds, siloxanes

These materials are often used in seals and show a high emission of siloxanes. Furthermore they are used in some oils and greases. Silicone sealant used for clean room construction should be approved by TNO before its usage.

Phthalates (softener)

Phthalates are used as softeners in high concentration e.g. in vinyl materials (PVC). Neither soft- (high concentration of softeners) nor hard-PVC materials (lower concentration of softeners) should be used in EUVL clean rooms.

Hydrocarbons with carbonyl functionalities

A typical example is 1-oxo-decane (decanal) with a boiling point at 207 °C as well as MMA (methyl metacrylate, which is an outgassing material of e.g. Perspex; MMA and can be replaced by polycarbonates). A cleaning of these compounds with standard methods is not possible.

1.2.2 Restricted materials

The usage of these materials should be avoided for as far as possible. If the material is to be used acceptance by TNO is mandatory.

Aliphatic hydrocarbons

Sources for these materials are solvents and detergents as well as outgassing compounds of other materials. The concentration of these materials is a critical item insofar, that the cleaning times for the optics increases with rising concentration.

Aromatic hydrocarbons

Typical examples for aromatic hydrocarbons are toluene and xylene. They are critical for the same reasons as aliphatic hydrocarbons.

Plastics

Plastics have to be tested concerning their outgassing behaviour as well as the outgassing materials. Depending on the method of manufacturing a permanent high outgassing is possible. It has to be checked, if a bake-out process previous to the use of the desired plastic leads to a reduction of the outgassing rate. Generally only known engineering plastics are allowed. Plastics containing phthalates or other softeners are completely forbidden.

Seals

Seals have to be free of silicones (no detectable outgassing).

It has to be kept in mind, that there is a high variety of viton seals available, which have different outgassing rates and amounts of silicones. The desired seal type has to be thoroughly checked upon its outgassing rate and its use has to be discussed with TNO first.

Glues, adhesives

Glues and adhesives based on siloxanes are forbidden materials.

Other glue materials (epoxy, cyane-acrylate, phenole resin) have to be checked upon their outgassing rate and the outgassing compounds. Every desired material has to be checked thoroughly and its use has to be discussed with the respective coordinator at TNO.

Greases, lubricants and oils based on PTFE

Lubricants, oils and greases, which contain PTFE are generally only accepted in a clean room version. Outgassing data needs to be provided to TNO before acceptance by TNO.

Lubricants based on MoS₂ und WS₂

The use of dry lubricants may cause the danger of particle release.

Colours and varnishes

The use of colors and varnishes is limited as they can release particles due to machinal contact.