The invention relates to the use of compounds of formulae (I) and/or (II) as colorless IR absorbers wherein M is Ni, Pd, Pt, Au, Ir, Fe, Zn, W, Cu, Mo, In, Mn, Co, Mg, V, Cr or Ti, X₁, X₂ and X₃ are each independently of the others sulfur or oxygen, R₁, R₂, R₃, R₄, R₅ and R₆ are each independently of the others hydrogen, NR₆, unsubstituted or substituted C₁₋₁₈alkyl, C₁₋₁₈ alky 1 wherein the alkylene chain is interrupted with oxygen, unsubstituted or substituted Q-C₆alkenyl, unsubstituted or substituted aryl, unsubstituted or substituted arlylalkyl or unsubstituted or substituted heteroarylalkyl, a further IR absorber optionally being added to the compounds of formulae (I) and (II). The invention relates also to novel dithiolene compounds of formulae (I) and (II) wherein X₁ is oxygen and X₂ and X₃ are oxygen or sulfur. The invention relates furthermore to novel dithiolene compounds of formulae (I) and (II) wherein R₁ to R₆ are NR₆.
The invention relates to the use of specific dithiolene metal complexes as colorless IR absorbers. The invention relates also to novel dithiolene metal complexes.

Colorless, or at least barely colored, IR absorbers meet a significant technical need in a wide range of applications, such as security printing (bank notes, credit cards, identity cards, passports etc.), invisible and IR readable bar codes, the laser-welding of plastics, the curing of surface-coatings using IR radiators, the drying and curing of print, the fixing of toners on paper, optical filters for PDPs (plasma display panels), laser marking, the heating of plastics preforms etc.

Several classes of IR absorbers are known, such as, for example, quinone-diimmonium or aminium salts, polymethines (e.g. cyanines, squaraines, croconaines), phthalocyanines and naphthalocyanines, dithiolene and other metal complexes. Newer structures, such as, for example, quaterrylene diimides, have also recently become known. Also known, besides those organic substances, are inorganic substances such as, for example, lanthanum hexaboride, indium tin oxide (ITO), antimony tin oxide (ATO) in nanoparticulate form and coated mica materials ("Lazerflair" from Merck).

Notwithstanding that large number of known compound classes and structures, as yet no IR absorbers have become known that are satisfactory from the technical standpoint. Especially in respect of "colorlessness", that is, minimum inherent color, no truly satisfactory solutions are known that simultaneously meet the other technical stability requirements (heat stability and/or light stability). IR absorbers, for example for security printing, are available, for example, from "American Dye Source", but virtually all of them have an absorption in the VIS range of the spectrum (from 400 to 700 nm).

It has now been found, surprisingly, that a class of heterocyclic dithiolene metal complexes, known per se, is able to meet those requirements. Especially in respect of colorlessness, these compounds are appreciably superior to the known IR absorbers - while simultaneously meeting other technical requirements, such as, for example, good fastness to light (for security printing) or good heat stability when incorporated into plastics material (laser-welding of plastics).
The invention accordingly relates to the use of compounds of formula I and/or II as colorless IR absorbers

$$\text{II}$$

$${}_1^{}\text{X}_1^{}\text{N=SSS}^{}\text{M}=\text{SSS}^{}\text{X}_2^{}\text{N=SSS}^{}\text{M}=\text{SSS}^{}\text{X}_3^{}$$

$${}_2^{}\text{X}_3^{}\text{N=SSS}^{}\text{M}=\text{SSS}^{}\text{X}_4^{}\text{N=SSS}^{}\text{M}=\text{SSS}^{}\text{X}_5^{}$$

wherein

- M is Ni, Pd, Pt, Au, Fe, Zn, W, Cu, Mo, Mn, Co, Mg, V, Cr or Ti,
- Xi, X2 and X3 are each independently of the others sulfur or oxygen,
- Ri, R2, R3, R4, R5 and R6 are each independently of the others hydrogen, NR7R8,
- unsubstituted or substituted C1-C18 alkyl, C1-C18 alkyl wherein the alkylene chain is interrupted with oxygen, unsubstituted or substituted CrC1-C8 alkenyl, unsubstituted or substituted aryl, unsubstituted or substituted arylalkyl or unsubstituted or substituted heteroarylalkyl, R7 and R8, each independently of the other, being unsubstituted or substituted C1-C18 alkyl, unsubstituted or substituted aryl, unsubstituted or substituted arylalkyl or unsubstituted or substituted heteroarylalkyl,
- a further IR absorber optionally being added to the compounds of formulae I and II.

Preference is given to compounds of formula I wherein the metal M is Ni, Pd or Pt. (claim 2)

If the substituents Ri to R6 or R1 to R4 are C1-C18 alkyl radicals they are preferably unsubstituted C1-C18 alkyl radicals, more preferably C1-C8 alkyl radicals, including straight-chain and branched and also cyclic alkyl radicals. The following may be mentioned as examples: propyl, isopropyl, n-butyl, sec-butyl, tert-butyl, n-hexyl, 2-ethylhexyl, n-octyl, cyclopentyl, cyclohexyl.

If the substituents Ri to R6 or R1 to R4 are d-C18 alkyl radicals wherein the alkylene chain is interrupted with oxygen, they are preferably -((CH2)n-O-(CH2)m)k-OCH3 with n = 2-6, m = 2 or 3, k = 1-6.
If the substituents $R_i$ to $R_6$ or $R_1$ to $R_4$ are $CrC_8$ alkenyl radicals they are preferably unsubstituted $CrC_8$ alkenyl radicals, more preferably $CrC_6$ alkenyl radicals. Examples may be vinyl or allyl.

If the substituents $R_i$ to $R_6$ or $R_1$ to $R_4$ are aryl groups, they are preferably unsubstituted aryl groups, for example, phenyl, naphthyl, anthryl or phenanthryl groups.

If the substituents $R_1$ to $R_6$ or $R_1$ to $R_4$ are arylalkyl groups, they are preferably unsubstituted arylalkyl groups, for example, $-(CH_2)_q$-phenyl with $q = 1-6$, especially benzyl, ethylphenyl, propylphenyl.

If the substituents $R_1$ to $R_6$ or $R_1$ to $R_4$ are heteroarylalkyl radicals they are preferably unsubstituted heteroarylalkyl radicals which denotes that a heteroaromatic ring is bonded directly to an alkyl group. The heteroaromatic ring is, for example, imidazolyl, pyridyl, thienyl, furyl, thiazolyl, indolyl, quinolinyl, pyrazolyl, pyrazyl, pyridazyl or pyrimidinyl.

The substituents $R_7$ and $R_8$ are preferably $CrC_6$ alkyl radicals.

In a preferred embodiment compounds of the formula I are used as colorless IR absorber wherein

$M$ is Ni, Pd, Pt,

$X_i$, $X_2$ and $X_3$ are each independently of the others sulfur or oxygen,

$R_i$, $R_2$, $R_3$, $R_4$ are each independently of the others $-N(CrC_6 alkyl)_2$, unsubstituted $Ci-C_8$ alkyl, $-(CH_2)_n$-$[O-(CH_2)_m]k$-$OCH_3$ with $n = 2-6$, $m = 2$ or $3$, $k = 1-6$; vinyl or allyl, $-(CH_2)_q$-phenyl with $q = 1-6$. (Claim 3)

Of particular interest are the structures Ia to Ih.
Colorless IR absorbers can be used in all fields of application that depend on the IR absorber's remaining invisible. The following uses may be mentioned by way of example:

1. Security printing (bank notes, credit cards, identity cards, passports etc.), invisible and IR readable bar codes, the laser-welding of plastics, the curing of surface-coatings using IR radiators, the drying and curing of print, the fixing of toners on paper, laser marking (plastics materials, paper, wood etc.) and the heating of plastics preforms. (Claim 5)

An especially suitable field of application is the use of the compounds of formula I and/or II in security printing and in the laser-welding of plastics material. (Claim 6)
In another embodiment the compounds of formulae I and II are used in security printing and printing of bar codes. (claim 7)

The IR absorbers of formulae I and II can also be in the form of mixtures with further known IR absorbers, especially mixtures with polymethines (cyanines, squaraines and croconaines). Such IR absorber mixtures are suitable especially for security printing. (claim 8)

Examples of preferred polymethines are listed in the following Tables:

**CYANINES**

<table>
<thead>
<tr>
<th>CYANINE 1</th>
<th>CYANINE 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Cyanine 1" /></td>
<td><img src="image2.png" alt="Cyanine 2" /></td>
</tr>
<tr>
<td><img src="image3.png" alt="Cyanine 3" /></td>
<td><img src="image4.png" alt="Cyanine 4" /></td>
</tr>
<tr>
<td><img src="image5.png" alt="Cyanine 5" /></td>
<td><img src="image6.png" alt="Cyanine 6" /></td>
</tr>
</tbody>
</table>
The IR absorbers are used in a concentration of from 10 ppm to 10 %, preferably 100 ppm to 2 % depending on the chosen application.

5 The laser welding is preferably carried out using an ND:YAG laser at 1064 nm or using a diode laser at 980 nm or 940 nm, and the concentration of IR absorber is, for example, from 5 to 500 ppm, preferably from 10 to 100 ppm.

In laser welding, plastics components are welded to one another. The dithiolenes according to the invention are suitable especially for welding transparent plastics materials, such as polypropylene, polyvinylbutyral, polyamide, polycarbonate, polycarbonate-polyethylene terephthalate blends, polycarbonate-polybutylene terephthalate blends, polycarbonate-acrylonitrile-styrene-acrylonitrile copolymer blends, polycarbonate-acrylonitrile-butadiene-styrene copolymer blends, polymethyl methacrylate-acrylonitrile-butadiene-styrene copolymer blends (MABS), polyethylene terephthalate, polybutylene terephthalate, polymethyl methacrylate, polybutyl acrylate, polymethyl methacrylate-polyvinylidene difluoride blends, acrylonitrile-butadiene-styrene copolymers (ABS), styrene-acrylonitrile copolymers (SAN) and polyphenylene sulfone and also mixtures thereof.

10 Especially advantageous in welding is the use of two identically transparent plastics workpieces, for example colorless-transparent/colorless-transparent or colored-transparent/colored-transparent.

20 In security printing, the IR absorber is added to the printing ink. Suitable printing inks are water-based, oil-based or solvent-based printing inks, based on pigment or dye, for inkjet
printing, flexographic printing, screen printing, intaglio printing, offset printing, laser printing or letterpress printing and for use in electrophotography.

The invention relates also to novel dithiolene compounds of formulae I and II wherein

\[ M \] is Ni, Pd, Pt, Au, Ir, Fe, Zn, W, Cu, Mo, In, Mn, Co, Mg, V, Cr or Ti,

\[ Xi \] is oxygen and \( X_2 \) and \( X_3 \) are oxygen or sulfur,

\[ R_i, R_2, R_3, R_4, R_5 \text{ and } R_6 \] are each independently of the others hydrogen, \( NR_7R_8 \), unsubstituted or substituted \( CrCl_8 \text{alkyl, } Ci-Ci_8 \text{alkyl wherein the alkylene chain is interrupted with oxygen, } \) unsubstituted or substituted \( Ci-Ci_8 \text{alkenyl, } \) unsubstituted or substituted aryl, unsubstituted or substituted arylalkyl or unsubstituted or substituted heteroarylalkyl, \( R_7 \text{ and } R_8 \), each independently of the other, being unsubstituted or substituted \( Ci-Ci_8 \text{alkyl, } \) unsubstituted or substituted aryl, unsubstituted or substituted arylalkyl or unsubstituted or substituted heteroarylalkyl. (Claim 9)

Those compounds are obtained from the corresponding sulfur compounds \( (Xi, X_2, X_3=S) \) by oxidation with a suitable solvent or as described by the examples.

The following compounds may be mentioned by way of example:

![chemical structures]

The invention relates also to novel dithiolene compounds of formulae I and II wherein

\[ M \] is Ni, Pd, Pt, Au, Ir, Fe, Zn, W, Cu, Mo, In, Mn, Co, Mg, V, Cr or Ti,

\[ Xi, X_2 \text{ and } X_3 \] are each independently of the others sulfur or oxygen,
Ri, R2, R3, R4, R5 and R6 are NR7R8, wherein R7 and R8 are each independently of the other unsubstituted or substituted C1-C8 alkyl, unsubstituted or substituted aryl, unsubstituted or substituted arylalkyl or unsubstituted or substituted heteroarylalkyl. (claim 10).

Preferably -NR7R8 is -N(C6 alkyl)2

The following compounds Ic and Id may be mentioned by way of example:

\[
\begin{align*}
\text{Ic} & \quad \text{Id}
\end{align*}
\]

The novel dithiolene compounds, like the known dithiolene compounds, are suitable for use in security printing (bank notes, credit cards, identity cards, passports etc.), invisible and IR readable barcodes, the laser-welding of plastics, the curing of surface-coatings using IR radiators, the curing and drying of print, the fixing of toners on paper, laser marking (plastics, paper, wood etc.) and the heating of plastics preforms etc.

Additionally, the novel dithiolene compounds of formulae I and II are suitable for use as optical filters for plasma display panels (PDPs). For this application absorption below 1000 nm, especially around 900 nm, is of special interest.

**Examples**

**Example 1** Preparation of

1,3-Diisopropyl-4,5-dioxo-imidazoline-2-thione is reacted under reflux conditions with metallic nickel and Lawesson's reagent in chlorobenzene.

Absorption maximum (chloroform): 1001 nm (79 000)

Example 2 Preparation of

Reaction is carried out analogously to Example 1, with platinum dichloride and Lawesson's reagent.

Absorption maximum (chloroform): 1000 nm (113 000).

Example 3a Preparation of

12.26 parts of N,N-dimethylhydrazine are added at room temperature, with stirring, to a solution of 7.65 parts of carbon disulfide in 250 parts of dichloroethane. The temperature is then increased to 40°C and stirring is carried out for 16 hours at that temperature to complete the reaction. The temperature is subsequently increased to 80°C for one hour.

A further 750 parts of dichloroethane are then added, and 13.88 parts of oxaly chloride (dissolved in a small amount of dichloroethane) are added dropwise over a period of 90 minutes. The reaction mixture is then heated to reflux and maintained at reflux for 2 hours, after which it is concentrated and the yellow crystals are filtered off and washed with a small amount of dichloroethane. After drying, 14 parts of product having the structure indicated above are obtained.
Example 3b Preparation of

0.333 part of platinum dichloride is added to a solution of 0.541 part of the product from example 3a and 1.085 parts of Lawesson's reagent in 50 parts of toluene. The reaction mixture is maintained at 110°C for 90 minutes and filtered while hot, and 500 parts of n-hexane are added to the filtrate after cooling. The resulting precipitate is filtered off and dried, yielding 0.5 part of product (absorption maximum 994 nm).

Example 4
The procedure is analogous to that in the previous examples, except that the metal used is molybdenum, thus yielding the corresponding 1:3 molybdenum complex:

Example 5 Preparation of

The compound from Example 2 is oxidised with atmospheric oxygen in dichloromethane at reflux temperature to form the corresponding oxo compound. Its absorption maximum is found at 968 nm.
Example 6a Preparation of

\[ \text{1,3-di-n-propyl-urea} \]

29.14 parts of 1,3-di-n-propyl-urea are dissolved in 300 parts of toluene at 40 °C. Over a period of 40 minutes 27.18 parts of oxalyl chloride are added at 80 °C to the stirred solution. After a further hour of stirring at 100 °C the solution is evaporated at 60 °C to dryness: 36.8 parts of the product are obtained.

Example 6b Preparation of

\[ \text{Product} \]

1.59 parts of the product from Example 6a, 1.06 parts of platinum dichloride and 3.47 parts of Lawesson’s reagent are heated to 110 °C under nitrogen in 100 parts of toluene. After 45 minutes reaction time the dark solution is cooled down to -10°C and the precipitation is filtered off, washed with ethanol and some acetone. For purification the crude product is dissolved in dichloromethane and precipitated slowly by addition of methanol. Dark blue crystals are collected by filtration. The absorption maximum of the product is found at 900 nm (chloroform).
Example 7  Preparation of

![Chemical structure](image)

Proceeding analogously to Example 6b but using palladium chloride instead of platinum chloride the corresponding palladium complex with an absorption maximum of 921 nm is obtained.

Example 8  Preparation of

![Chemical structure](image)

Proceeding analogously to Example 6b but using metallic nickel instead of platinum chloride the corresponding nickel complex with an absorption maximum of 891 nm is obtained.

Example 9 to 24

Compounds of Examples 9 to 24 (structures given in the table below) are obtained by analogous procedures as described in Examples 1 to 8:
<table>
<thead>
<tr>
<th>Example</th>
<th>Structure</th>
<th>Example</th>
<th>Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td><img src="image" alt="Structure 9" /></td>
<td>10</td>
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</tr>
<tr>
<td>990 nm</td>
<td></td>
<td>1020 nm</td>
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<td>11</td>
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<td></td>
<td>999 nm</td>
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<td>1009 nm</td>
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<td>991 nm</td>
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<td><img src="image" alt="Structure 16" /></td>
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<td>1007 nm</td>
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<td><img src="image2" alt="Chemical Structure 2" /></td>
<td></td>
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<tr>
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<td>--------------------------------</td>
<td>--------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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<tr>
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<td><img src="image8" alt="Chemical Structure 8" /></td>
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<tr>
<td></td>
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</tr>
<tr>
<td>24</td>
<td><img src="image14" alt="Chemical Structure 14" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Application Examples

Example A1 (Security printing)
5 11.9 parts of vinyl chloride, 2.1 parts of vinyl acetate, 10 parts of ethoxypropanol, 75.5 parts of methyl ethyl ketone and 0.5 part of the product from Example 1 are shaken together with 150 g of glass beads for 30 minutes in a Skandex mixer.
The resulting printing ink is applied to contrast paper using a doctor blade (film thickness when damp: 6 µm). The print is visually colorless, but is clearly visible in the IR range using an IR-viewing device (cut-off filter 715 nm). The fastness to light is excellent.

Example A2 (security printing)
By proceeding as indicated in Example A1 but using the IR absorber from Example 2, there accordingly is likewise obtained a colorless print having excellent fastness to light, which is clearly visible in the infrared range using an IR-viewing device.

Example A3 (Laser-welding of plastics material)
20 Using an injection-moulding machine, the IR absorber from Example 1 is incorporated into a polycarbonate disc having a thickness of 2 mm (concentration: 100 ppm). Using an Nd:YAG laser, the resulting, virtually colorless disc is welded at a power of 30 watt and a rate of advance of 20 mm/s to a second 1 mm-thick pure polycarbonate disc not containing IR absorber. The resulting weld is characterised by an excellent bond, unchanged transparency, no melt irruptions and no bubbling. Under heavy mechanical loading, breakage of the discs does not occur at the welded seam.

Example A4 (Laser-welding of plastics material)
30 By proceeding as indicated in Example A3 but using the IR absorber from Example 2, a virtually colorless polycarbonate disc is likewise obtained which has excellent welding properties. The resulting weld has unchanged transparency, the welding leaves no melt irruptions or bubbling and the strength of the weld is excellent.
Examples A5 and A6
By proceeding as indicated in Examples A3 and A4 but, instead of using an Nd:YAG laser (1064 nm), using a diode laser having an emission wavelength of 980 nm, similarly good results to those described in Examples A3 and A4 are obtained.

Examples A7 and A8
By proceeding as indicated in Examples A3 and A4 but, instead of using an Nd:YAG laser (1064 nm), using a diode laser having an emission wavelength of 940 nm, a comparably good weld is obtained at a laser power of 80 watt.

Example A9
By proceeding as indicated in Example A3, but using polypropylene discs having a thickness of 1.5 mm, the welds obtained are likewise very good.
Claims:

1. Use of compounds of formulae I and/or II as colorless IR absorbers

\[ \begin{align*}
\text{I} & : \quad \begin{array}{c}
R_1 & \quad \text{X} & \quad R_3 \\
\text{M} & \quad \text{X}_1 & \quad R_2 \\
\text{X}_2 & \quad \text{X}_3 & \quad \\
\end{array} \\
\text{II} & : \quad \begin{array}{c}
R_1 & \quad \text{X} & \quad R_4 \\
\text{M} & \quad \text{X}_1 & \quad R_2 \\
\text{X}_2 & \quad \text{X}_3 & \quad \\
\end{array}
\end{align*} \]

wherein
\[ M \text{ is } \text{Ni, Pd, Pt, Au, Ir, Fe, Zn, Cu, Mo, In, Mn, Co, Mg, V, Cr or Ti,} \]
\[ \text{Xi, } \text{X}_2 \text{ and } \text{X}_3 \text{ are each independently of the others sulfur or oxygen,} \]
\[ \text{Ri, R}_2, \text{ R}_3, \text{ R}_4, \text{ R}_5 \text{ and } \text{R}_6 \text{ are each independently of the others hydrogen, } \text{NR}_7\text{R}_8, \]
unsubstituted or substituted Cr\( \text{C}_\text{alkyl, Cr-C}_\text{alkyl wherein the alkylene chain is interrupted}
\]
with oxygen, unsubstituted or substituted Cr\( \text{C}_\text{alkenyl, unsubstituted or substituted ary1,}
\]
unsubstituted or substituted ary1 alkyl or unsubstituted or substituted heteroaryl alkyl, \( R_7 \text{ and } \)
\[ \text{R}_8 \text{ each independently of the other, being unsubstituted or substituted C1-C}_8\text{alkyl,}
\]
unsubstituted or substituted ary1, unsubstituted or substituted ary1 alkyl or unsubstituted or
substituted heteroaryl alkyl,
\[ \text{a further IR absorber optionally being added to the compounds of formulae I and II.} \]

2. Use of compounds of the formula I according to claim 1 wherein M is Ni, Pd or Pt

as colorless IR absorbers.

3. Use of compounds of the formula I according to claim 1 as colorless IR absorber

wherein
\[ M \text{ is Ni, Pd, Pt,} \]
\[ \text{Xi, } \text{X}_2 \text{ and } \text{X}_3 \text{ are each independently of the others sulfur or oxygen,} \]
\[ \text{Ri, R}_2, \text{ R}_3, \text{ R}_4 \text{ are each independently of the others } -\text{N(C1-C}_8\text{alkyl)}_2, \text{ unsubstituted} \]
\[ \text{C1-C}_8\text{alkyl, } -(\text{CH}_2)_n-[\text{O-(CH}_2\text{m}]-\text{OCH}_3 \text{ with } n = 2-6, m \geq 2 \text{ or } 3, k = 1-6; \text{ vinyl or allyl,} \]
\[ -(\text{CH}_2)_q-\text{phenyl with } q = 1-6. \]
4. Use of a compound of formula Ia, Ib, Ic, Id, Ie, If, Ig or Ih according to claim 1 as colorless IR absorbers.

5. Use of compounds of formulae I and II according to any one of claims 1-4 for security printing, invisible and IR readable bar codes, the laser-welding of plastics, the curing of surface-coatings using IR radiators, the drying and curing of print, the fixing of toners on paper, laser marking and the heating of plastics preforms.
6. Use of compounds of formulae I and II according to claim 5 for the laser-welding of plasties materials.

7. Use of compounds of formulae I and II according to claim 5 in security printing and printing of bar codes.

8. Use of compounds of formulae I and II according to claim 1 in admixture with further IR absorbers from the group of the polymethines.

9. Compounds of formulae I and/or II

wherein
M is Ni, Pd, Pt, Au, Ir, Fe, Zn, W, Cu, Mo, In, Mn, Co, Mg, V, Cr or Ti,
X is oxygen,
\( X_2 \) and \( X_3 \) are each independently of the other sulfur or oxygen,
R, R2, R3, R4, R5 and R6 are each independently of the others hydrogen, \( NR_7R_8 \),
unsubstituted or substituted \( \text{CrCl}_3 \) alkyl, \( \text{Cl-Cl}_8 \) alkyl wherein the alkylene chain is interrupted with oxygen, unsubstituted or substituted \( \text{Cl-Cl}_3 \) alkenyl, unsubstituted or substituted aryl, unsubstituted or substituted aroyalkyl or unsubstituted or substituted heteroarylalkyl, \( R_7 \) and \( R_8 \), each independently of the other, being unsubstituted or substituted \( \text{Cl-Cl}_3 \) alkyl, unsubstituted or substituted aryl, unsubstituted or substituted aroyalkyl or unsubstituted or substituted heteroarylalkyl.

10. Compounds of formulae I and/or II
wherein

M is Ni, Pd, Pt, Au, Ir, Fe, Zn, W, Cu, Mo, In, Mn, Co, Mg, V, Cr or Ti,

Xi, X₂ and X₃ are each independently of the others sulfur or oxygen,

R₁, R₂, R₃, R₄, R₅ and R₆ are NR₇R₈, wherein R₇ and R₈ are each independently of the other unsubstituted or substituted CrCl₈alkyl, unsubstituted or substituted aryl, unsubstituted or substituted arylalkyl or unsubstituted or substituted heteroarylalkyl.

11. Use of compounds according to claims 9 and 10 for security printing, bar codes, the laser-welding of plastics, the curing of surface-coatings using IR radiators, drying and curing of print, the fixing of toners on paper or plastics, laser marking of plastics, paper and other natural or synthetic materials and the heating of plastics performs and also for optical filters for plasma display panels (PDPs).
**INTERNATIONAL SEARCH REPORT**

**International application No**
PCT/EP2007/064102

**A. CLASSIFICATION OF SUBJECT MATTER**
INV. B29C65/16 B41M3/14 C07D239/22 C07F15/00 C07F15/04
C07F19/00 G02B5/20 G03G11/00

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
B29C B41M C07D C07F G02B G03G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, CHEM ABS Data, BEILSTEIN Data, COMPENDEX

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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**Further documents are listed in the continuation of Box C**

**Soc patent family annex**

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Date of the actual completion of the international search: 23 April 2008
Date of mailing of the international search report: 09/05/2008

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Fax (+31-70) 340-3016

Authorized officer: Elliott, Adrian

Form PCT/ISA/210 (second sheet) (April 2005)
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