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| **Programme:** | **IDEI** |
| **Project type:** | **Exploratory Research Projects** |
| **Project:** | **PCE\_2012-4-0261** |
| **Contact No.** | **53/02.09.2013** |
| **Project name:** | **New coordination networks containing polyfunctional flexible bridges** |

**Scientific Report**

**2015**

**Objectives:**

**1.Preparation of the extended networks containing metals by using the obtained ligands** *(continued)*

1.1.Preparation of networks based on flexible organosilicon ligands and metal salts.

1.2.Determining the chemical and structural composition of the obtained metal complexes by using physical methods of analysis: elemental analysis, TGA, FTIR (MIR/FIR), EDXRF, XRD

1.3.Selection of the interest structures and their investigation by SEM, TEM, AFM to evaluate the morphology and porosity; study of the surface properties by DVS.

**2. Preparation of the extended networks based on preformed or in situ clusters and the obtained ligands**

2.1. Preparation of networks based on flexible ligands and different metallic precursors

2.2. Determining the chemical composition and the structure of the obtained metal complexes by using physical methods of analysis: elemental analysis, TGA, FTIR (MIR/FIR), EDXRF, XRD and single crystal X-ray diffraction.

2.3. Selection of the interest structures and their investigation by SEM, TEM, AFM to evaluate the morphology and porosity; study of the surface properties by DVS.

**Expected results:**

**🗹At least a novel metallo-silicon network** – ***achieved objective***

***Seven new metallo-silicon networks*** based on carboxylic acid and Schiff base ligands synthesized in the previous stages of the project and metal ions of the transition metals were obtained. Their structures were confirmed by elemental analysis, spectral methods (FTIR, UV-vis, ESI-MS) and by single crystal X-ray diffraction analysis.The evaluation of the thermal, morphological and surface properties of the prepared metallo-silicon networks was done by specific methods: thermogravimetrical analysis, AFM, SEM, TEM, EDXRF.

**🗹At least a novel network containing metallic clusters and flexible bridges** – ***achieved objective.***

***Seven novel structures containing metallic clusters and flexible (siloxane and/or alkyl) bridges were obtained*** on the basis of metal ions and carboxylic acids and Schiff base ligands synthesized in the previous stages of the project.Their structures were confirmed by elemental analysis, spectral methods (FTIR, UV-vis, ESI-MS) and by single crystal X-ray diffraction analysis.The evaluation of the thermal, morphological and surface properties of the prepared metallo-silicon networks was done by specific methods: thermogravimetrical analysis, AFM, SEM, TEM, EDXRF.

**🗹*At least two presentation at scientific meetings***- ***achieved objective***.

The results of the research carried out in this stage of the project have been presented at national and international scientific events in the form of oral presentations (**11**) and posters (**5**).

**🗹*At least two scientific articles submitted at ISI journals***-***achieved objective.***

The results obtained in this stage of the project have been published in ISI journals, their number being larger than expected, **11 being published.**

**🗹Scientific report*achieved objective.***

***Table including some of the synthesized compounds in this stage of the project***

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| **No.** | **Compounds/structure type** | **Confirmation and investigation methods** | | ***Remarks*** | |
| ***Objective 1.*** Preparation of the extended networks containing metals by using the obtained ligands *(continued)* ***Expected indicator: at least a novel metallo-silicon network;Achieved: 7*** | | | | | |
| **1.** | XRD structure of the coordination network **{[Zn2(COO)4(DMF)2]·0.8DMF}n**  **IR** *ν*max (KBr), cm-1: 3431w, 3067w, 3049w, 2930w, 1676s, 1624vs, 1543m, 1497s, 1410, 1383s, 1254m, 1190m, 1107w, 1063w, 1001w, 845m, 773vs, 723m, 706m, 635m, 540w, 509w, 476vw, 430vw, 384vw.  **Anal**.Calcd. for C60.4H55.6N2.8O10.8Si2Zn2 (Mr 1180.4 g/mol): C, 61.41 %; H, 4.71 %; N, 3.32 %. Found: C 61.28 %; H 4.72 %; N 3.29 %.  D:\My Documents\Desktop\tg zn pol.tif  FTIR spectrum and TG/DTG curves of the coordination polymer {[Zn2(COO)4(DMF)2]·0.8DMF}n | FTIR  Elemental analysis  UV-vis  XRD  TG/DTG  DSC  DVS | | Indicator of achievement | |
| **2.** | 1D  XRD structure of the coordination network **[CuL2]n**  **IR** *ν*max (KBr), cm-1: 3443w, 3059vw, 3042vw, 2955m, 2920m, 2903m, 2855w, 1711vs, 1655m, 1622vs, 1589vs, 1543vs, 1501m, 1450s, 1396s, 1344m, 1313vs, 1306vs, 1248vs, 1198s, 1173s, 1109s, 1082m, 1018m, 988w, 974m, 856vs, 766s, 739m, 702m, 669w, 625w, 559w, 496m, 419w, 397w.  **Anal. Calcd. for**: C42H48N2O8Si2CuCl4 (Mr=970,3772 g-mol): C, 51.98; H, 4.98; N, 3.71. Found C, 52.24; H, 4.81; N, 3.73.  **ESI-MS**: *m*/*z* 637 [Cu(HL2)]2+ și  *m*/*z* 1561 [M + H]+.    Sorption/desorption isotherms and TEM image of the coordination polymer [CuL2]n | FTIR  Elemental analysis  ESI-MS  UV-vis  XRD  TG/DTG  DSC  DVS  TEM | | Indicator of achievement | |
| **3.** | **D_54_MZ**  Dimeric associate in the crystal network of the complex **[Zn(L)2]**  **IR** *ν*max (KBr), cm-1: 3387w, 3076vw, 2951m, 2891m, 1699vs, 1612s, 1599vs, 1568s, 1541m, 1506w, 1491m, 1468m, 1447m, 1414m, 1379m, 1350vw, 1319s, 1279vs, 1246s, 1180s, 1150s, 1126s, 1113s, 1063w, 1030w, 1015w, 991w, 961m, 912m, 856s, 839vs, 772s, 758s, 694s, 636w, 600w, 590w, 582w, 561vw, 526w, 517w, 492w, 447w, 405w.  ***ESI-MS****: m/z* 774.3 ([Zn(L)2]), 797.2 ([Zn(L)2 + Na]+)  **Anal. Calcd. for**: C40H48N2O6Si2Zn (Mr 774.35 g/mol): C, 62.34; H, 6.28; N, 3.61. Found C, 62.04; H, 6.25; N, 3.62.  D:\My Documents\Desktop\mszn_.tif  FTIR and MS spectra of the complex ([Zn(L)2 | FTIR  Elemental analysis  ESI-MS  UV-vis  XRD  TG/DTG | | Indicator of achievement | |
| 4. | P1_1794  View of 3D network in the crystal structure of the complex ZnHL2  **IR** *ν*max (KBr), cm-1: 3377m, 3082vw, 3049vw, 2982vw, 2949m, 2891w, 2847vw, 1693s, 1634vs, 1603s, 1553m, 1501s, 1458m, 1439m, 1429w, 1394w, 1369m, 1346w, 1329m, 1290s, 1248s, 1236s, 1194s, 1169vs, 1126vs, 1113vs, 1072s, 1047s, 1013m, 989vw, 974vw, 959m, 949m, 903w, 868s, 851s, 841s, 787m, 768m, 746s, 735s, 687m, 665w, 623s, 575w, 527m, 496m, 449w, 430w, 417w.  **Anal. Calcd. for**: C42H58N2O18Si2ZnCl2  (Mr 1071.35 g/mol): C, 47.03; H, 5.46; N, 2.61. Found C, 47.41; H, 5.68; N, 2.55.  **ESI-MS**: *m/z* 834.3    TG and DTG curves of the coordination network [ZnHL2]n | FTIR  Elemental analysis  ESI-MS  UV-vis  XRD  TG/DTG | | Indicator of achievement | |
| 5. | shI_2578_AV  XRD structure of the complex Cu-L  **IR** *ν*max (KBr), cm-1:3057vw, 2953m, 1620vs, 1549m, 1472s, 1448s, 1402m, 1329m, 1312m, 1246vs, 1223s, 1198w, 1169m, 1107s, 1082s, 1061s, 970m, 945w, 881w, 839s, 795m, 785m, 741s, 708w, 623m, 565vw, 469w;  **Anal. Calcd** for C26H38CuN2O5Si2 (Mr 578.3 g/mol): C, 55.99; H, 6.62; N, 4.84. Found: C, 56.08; H, 6.68; N, 4.78;  ESI-MS: *m/z* 578.3 ([M]), 596.35 ([M+H2O])  **P1_2578 P2_2578**  Supramolecular polymeric chain and view of the crystal structure on the crystallographic axis *b* | FTIR  Elemental analysis  ESI-MS  UV-vis  XRD  Superficial tension  AFM  TEM | | Indicator of achievement | |
| **6.** | shI_2644_AV  XRD structure of the complex Zn-L  **IR** *ν*max (KBr), cm-1: 3051w, 3026w, 2947m, 2924m, 2905m, 2878w, 1626vs, 1601s, 1537s, 1468s, 1448vs, 1400s, 1342s, 1319s, 1252s, 1190s, 1163m, 1150s, 1126m, 1078vs, 1026m, 995w, 986w, 912m, 883m, 878m, 853m, 837s, 793s, 777m, 766s, 754s, 741m, 704m, 667w, 636w, 602m, 561w, 546w, 519w, 465m, 451m, 386w;  **Anal.** Calcd for C24H34N2O3Si2Zn (Mr 520.08 g/mol): C, 55.37; H, 6.53; N, 5.38. Found: C, 55.48; H, 6.36; N, 5.39;  **ESI-MS**: *m/z* 519.44 ([M+]), 541.32 ([M+Na]+), 1039.32 ([2·M+]), 1063.40 ([2·M+Na]+), 1583.72 ([3·M+Na]+).  P1_2644 P2_2644  Supramolecular polymeric chain and view of the crystal structure on the crystallographic axis *c* | FTIR  Elemental analysis  ESI-MS  UV-vis  XRD  Superficial tension  AFM  TEM | | Indicator of achievement | |
| **7.** | m1  XRD molecular structure of ferrocenyl-siloxane uree FSU  P1 P2  View of the crystal structure on the crystallographic axis *a* and supramolecular polymer chain in the crystal structure  Figure 12  TEM and STEM images of FSU from chloroform; EDX image of FSU | FTIR  Elemental analysis  ESI-MS  UV-vis  1H-NMR  XRD  EDX  TEM | | Indicator of achievement | |
| ***Objective 2.* Preparation of the extended networks based on preformed or in situ clusters and the obtained ligands*; Expected indicator: At least a novel network containing metallic clusters and flexible bridges; Achieved: 7.*** | | | | | |
| **1.** | Chemical structure of the tetranuclear complex  [Cu4(μ4-O)(L1)2Cl4]  **FTIR** (KBr): 3549 (w), 3416 (m), 2951(m), 2918 (m), 2899 (m), 2868 (m), 1634 (vs), 1618 (s), 1562 (vs),1458 (s), 1410 (m), 1385 (m), 1342 (s), 1306 (w), 1288 (w), 1254 (s),1186 (m), 1051 (s), 991 (m), 968 (w), 874 (w), 835 (vs), 797 (s), 777(s), 768 (s), 741 (w), 702 (w), 619 (m), 571 (w), 532 (vw), 509 (m),492 (m) cm–1. **UV/Vis** (CHCl3): *λ*max (*ε*, m–1cm–1) = 375 (19180), 655 (236) nm. MS (ESI+): *m*/*z* = 1127 [Cu4(μ4-O)(**L1**)Cl3]+.  **Anal.** Calc. for C38H62Cl4Cu4N4O5Si4 (1163.3): C 39.23, H 5.37, N 4.81; Found C 39.02, H 5.19, N 4.70.  shi_159  FTIR spectrum and XRD structure of the complex [Cu4(μ4-O)(L1)2Cl4] | FTIR  UV-vis  Elemental analysis  ESI-MS  XRD | | Indicator of achievement | |
| **2.** | Chemical structure of the tetranuclear complex  [Cu4(μ4-O)(L2)2Cl4]  **Anal** calc. for C62H74Cl4Cu4N4O11Si4 (1559.6):  C 47.75, H 4.78, N 3.59; Found: C 47.67, H 4.64, N 3.62.  **FTIR (**KBr): 3416 (m), 3061 (vw), 2955 (m), 2922 (w), 2903 (w),  1711 (vs), 1624 (vs), 1587 (s), 1543 (vs), 1502 (m), 1420 (m), 1398 (m), 1346 (m), 1315 (vs), 1306 (vs), 1250 (vs), 1196 (m), 1175 (s), 1109 (s), 1082 (s), 1018 (m), 1001 (w), 980 (w), 955 (w), 856 (vs), 766 (s), 702 (m), 663 (vw), 623 (w), 557 (w), 496 (m), 417 (w) cm–1.  **UV/Vis** (CHCl3): *λ*max (*ε*, m–1cm–1) = 384 (38300), 415 (38060), 745 (550) nm.  **MS (ESI+):** *m*/*z* = 1561 [M + H]+, 637 [Cu(HL2)]2+.  m2  FTIR spectrum and XRD structure of the complex  Cu4(μ4-O)(L2)2Cl4] | FTIR  UV-vis  Elemental analysis  ESI-MS  XRD | | Indicator of achievement | |
| **3.** | Chemical structure of the dinuclear complex [Co2Cl2L4]  **IR** *ν*max (KBr), cm-1: 3425m, 3057vw, 2955m, 2904w, 1714vs, 1636vs, 1599s, 1537vs, 1501m, 1414w, 1388, 1313vs, 1303vs, 1249vs, 1237s, 1198s, 1172s, 1110s, 1071m, 1015m, 1000m, 854vs, 766s, 732w, 701m, 622vw, 602vw, 519w, 395w.  **Anal.** Calc for C124H148Cl6Co3N8O20Si8: C 55.47, H 5.56, N 4.17; Found: C 55.68, H 5.64, N 4.62.  **ESI-MS**: m/z 1204 (1/2 [Co2Cl2L4]).    XRD structure of the complex [Co2Cl2L4]·4CH3CN·0.25H2O and the projection of the coordinative node Co2    FTIR spectrum of the complex [Co2Cl2L4] | FTIR  UV-vis  Elemental analysis  ESI-MS  XRD | | Indicator of achievement | |
| **4.** | **IR** *ν*max (KBr), cm-1: 3443w, 3058vw, 2951m, 2893m, 1720vs, 1623s, 1544vs, 1502m, 1447w, 1397m, 1387m, 1347m, 1248s, 1180s, 1105s, 1082, 1017m, 979w, 860vs, 836s, 766w, 696m, 626w, 558w, 497m, 428vw, 385vw.  **UV/Vis** (DMF): *λ*max (*ε*, m–1cm–1) = 288 (26154), 412 (10566) nm.  **Anal**. Calc for C70H92.5Cl4Cu4N4O12.75Si4 (Mr 1702.3 g/mol): C 49.39, H 5.48, N 3.29; Found: C 50.08, H 5.61, N 3.62.  D:\My Documents\Desktop\acp2cu.tif  FTIR and UV-vis spectraof the complex [Cu4(μ4-O)(LA)2Cl4]    XRD structure of the tetranuclear complex [Cu4(μ4-O)(LA)2Cl4] and view of the coordinative node µ4-O Cu4 | FTIR  UV-vis  Elemental analysis  ESI-MS  XRD | | Indicator of achievement | |
| **5.** | XRD structure of the coordination network  [Mn6(µ3-O)2(salox)6(H2salox)(H2O)3L]  **IR** νmax (KBr), cm-1: 3388vs, 3053m, 2952m, 2925m, 2886m, 1707m, 1618s, 1600vs, 1536vs, 1498m, 1473s, 1442s, 1410s, 1358w, 1335m, 1313m, 1284s, 1264s, 1200m, 1152m, 1125m, 1043s, 1027vs, 958m, 919s, 896m, 838m, 787s, 748s, 677s, 648s, 560w, 531m, 472m, 401w.  **UV-Vis** (DMF), λmax, nm (ε, dm3mol-1cm-1): 286 (87100), 380 (27474).  **Anal** calc. for C68H75.4Mn6N8O27.2Si2 (Mr 1825. 78 g/mol): C 44.73.9, H 4.16, N 6.14; Found: C 45.02, H 4.42, N 6.32.    The structure of the hexanulear cluster [Mn6(µ3-O)2(salox)6(H2salox)(H2O)3L] and view of the coordination polyhedra of the manganese atoms in hexanuclear cluster  Mn6(µ3-O)2    TG/DTG and DSC curves of the coordination polymer  [Mn6(µ3-O)2(salox)6(H2salox)(H2O)3L] | FTIR  UV-vis  Elemental analysis  ESI-MS  XRD  TG/DTG  DSC  DVS  AFM  SEM  TEM | | Indicator of achievement | |
|  | Sorption/desorption isotherms and AFM images of the coordination polymer [Mn6(µ3-O)2(salox)6(H2salox)(H2O)3L]    TEM and SEM images of the coordination polymer  [Mn6(µ3-O)2(salox)6(H2salox)(H2O)3L] from chloroform |  | |  | |
| **6.** | **{[Mn5L(cpdps)4(HCOO)2(H2O)2(DMF)4]·6DMF}n**  5_12  View of the pentanuclear cluster [Mn5] in the crystal structure of of the coordination network  5_45_8  Connection of adjacent secondary building units [Mn5] by carboxylate ligands and view of the 3D structure of the coordination network | FTIR  UV-vis  Elemental analysis  ESI-MS  XRD  TG/DTG  DSC  DVS | | Indicator of achievement | |
| **7.** | **{Mn3(μ-H2O)2(Hcpdps)2(cpdps)2(DMF)2]∙2DMF∙12H2O}n**  **Fig_3**  View of the trinuclear cluster in the crystal structure of the coordination network  3_1  View of the 3D network in the crystal structure of the trinuclear complex    TG/DTG curves of the pentanuclear and trinuclear coordination networks    Sorption/desorption isotherms of the pentanuclear and trinuclear coordination networks | FTIR  UV-vis  Elemental analysis  ESI-MS  XRD  TG/DTG  DSC  DVS | | Indicator of achievement | |
| **Expected indicator: At least one presentation at scientific meeting**; **Achieved: 16**  **Presentations at International Scientific Meetings-2015**   1. Zaltariov, M., Cazacu, M., Shova, S., **Structural diversity in Cu(II) and Co(II) complexes induced by flexible ligands,** *Seventh Cristofor I. Simionescu Symposium Frontiers in Macromolecular and Supramolecular Science 4-5 June,* ***2015****, Iasi, Romania- oral presentation.* 2. Iacob, M., Racles, C., Tugui, C., Stiubianu, G., Cazacu, M., **μ3-oxotrinuclear iron carboxy-clusters as effective alternative sources for their oxide nanoparticles.** *15th International Balkan Workshop on Applied Physics*, *Constanta, 2-4 June* ***2015-*** *oral presentation.* 3. Iacob, M., Stiubianu, G., Tugui, C., Bele, A., Cazacu. M., **Managing silicone electromechanical properties through inorganic nanoparticles fillers**. *14th World Renewable Energy Congress - WREC* ***2015*,** *Bucuresti, Romania, 8-12 iunie*- *oral presentation.* 4. Iacob, M., **Silicon nanocomposites as dielectric elastomers**. *Modern Science and Energy, The XXXIII-rd Edition, Cluj, 14-15 May* ***2015 -*** *oral presentation.* 5. Iacob, M., Cazacu, M., Racles, C., Patras, X., Stiubianu, G., Tugui, C., Bele, A., Sacarescu, L., Turta, C. **Preparation of magnetic nanoparticles for biomedical applications.** *International Congress “Preparing the future by promoting the excellence“, The XXV-th Edition, Section B– Landmarks in modern medicine. Apollonia University, Iasi, Romania 26 february – 1 march* ***2015****- oral presentation.* 6. Zaltariov, M., Vlad, A., Cazacu, M., Shova, S., **Discrete structures and extended networks built by flexible ligands and Zn(II) ions**, *19-th Romanian International Conference on Chemistry and Chemical Engineering September 2-5 ,* ***2015****, Sibiu, Romania- oral presentation.* 7. Zaltariov, M., Cazacu, M., Vlad, A., Shova, S., **Mn(II) and Zn(II)-organic frameworks: toward new magnetic and luminescent materials**, *The 3rd CEEPN Workshop on Polymer Science, September 23-26,* ***2015,*** *Iasi, Romania- oral presentation.* 8. Cazacu, M., Soroceanu, A., Zaltariov, M., **Metal complexes with ligands containing dimethylsiloxane units: self-assembling ability***, The XVIII-th International Conference "Physical Methods in Coordination and Supramolecular Chemistry"**(dedicated to the memory of professor Constantin Turta and professor Mihail Revenco), October 8 – 9,* ***2015,*** *Chişinău, Moldova- oral presentation* 9. Dascalu, M., Balan, M., Shova,S., Racles, C., Cazacu, M., **Ferrocenylsiloxane urea: synthesis, structure and properties,** *The XVIII-th International Conference "Physical Methods in Coordination and Supramolecular Chemistry"**(dedicated to the memory of professor Constantin Turta and professor Mihail Revenco), October 8 – 9****, 2015,*** *Chişinău, Moldova- oral presentation* 10. Vlad, A., Cazacu, M., Shova, S., Zaltariov, M., **Self-Assembled Cu(II) Coordination Complexes Based on Mixed Ligands: Silicon-Containing Carboxylic Acids and N-Donor Ligand** *- 19-th Romanian International Conference on Chemistry and Chemical Engineering September 2-5 ,* ***2015****, Sibiu, Romania-poster.* | | | Result indicator | |
| 1. Vlad, A., Zaltariov, M., Cazacu, M., Shova, S., **2D manganese(II) networks based on V-shaped bis(*p*-carboxyphenyl)diphenylsilane: synthesis, structures and properties,** *The XVIII-th International Conference "Physical Methods in Coordination and Supramolecular Chemistry"**(dedicated to the memory of professor Constantin Turta and professor Mihail Revenco), October 8 – 9****, 2015,*** *Chişinău, Moldova-poster.* 2. Iacob, M., Tugui, C., Sirbu, D, Stiubianu, G., Cazacu, M., **Superparamagnetic iron oxide nanowires self-assembled into smectic crystal.** *The XVIIIth International Conference "Physical Methods in Coordination and Supramolecular Chemistry". Chişinău, Moldova, 8-9 Octombrie* ***2015,*** *poster.*   **Presentations at National Scientific Meetings--2015**   1. Zaltariov, M., Cazacu, M., Shova, S., Vlad, A., **Synthesis, structural characterization and magnetic properties of a polymerc complex built by hexanuclear clusters and flexible ligands,** *Iasi Academic Days-The XXV-th Session of scientific communications of „Petru Poni„ Institute of Macromolecular Chemistry Iasi, 24 - 26 september* ***2015****- oral presentation* 2. Soroceanu, A., Cazacu, M., **Metallic complexes with Schiff base ligand containing siloxane segment,** *Iasi Academic Days-The XXV-th Session of scientific communications of „Petru Poni„ Institute of Macromolecular Chemistry Iasi, 24 - 26 september* ***2015****- oral presentation* 3. Vlad, A., Cazacu, M., Shova, S., Zaltariov, M., **Metallic complexes of flexible Schiff bases self-assembled in supramolecular structures,** *Iasi Academic Days-The XXV-th Session of scientific communications of „Petru Poni„ Institute of Macromolecular Chemistry Iasi, 24 - 26 september* ***2015****- poster* 4. Zaltariov, M., Vlad, A., Cazacu, M., Shova, S., **Cu(II) and Zn(II) complexes of Schiff bases derived from trimethylsilyl-propyl-*p*-aminobenzoate, Zaltariov**, *Iasi Academic Days-The XXV-th Session of scientific communications of „Petru Poni„ Institute of Macromolecular Chemistry Iasi, 24 - 26 september* ***2015****- poster.* | | |  | |
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| **(Expected indicator: At least two scientific articles submitted at ISI journals; Achieved: 11 (articles published in ISI journals).**  **Published articles:**   1. Zaltariov, M. F., Cazacu, M., Vlad, A., Sacarescu, L., Shova, S., Coordination polymer of copper with a silicon-containing Schiff base: synthesis, structural characterization, properties, *High Perform. Polym.* **2015**, *27(5),* 607–615. 2. Zaltariov, M. F., Cazacu, M., Avadanei, M., Shova, S., Balan, M., Vornicu, N., Vlad, A., Dobrov, A., Varganici, C. D., Synthesis, characterization and antimicrobial activity of new Cu(II) and Zn(II) complexes with Schiff bases derived from trimethylsilyl-propyl-*p*-aminobenzoate, *Polyhedron* **2015**, *100*, 121–131. 3. Cazacu, M., Shova, S., Soroceanu, A., Machata, P., Bucinsky, L., Breza, M., Rapta, P., Telser, J., Krzystek, J., Arion, V. B., Charge and spin states in Schiff base metal complexes with a disiloxane unit exhibiting a strong noninnocent ligand character: synthesis, structure, spectroelectrochemistry, and theoretical calculations, Inorg. Chem., **2015**, 54 (12), 5691–5706. 4. Soroceanu, A., Cazacu, M., Racles, C., Stoica, I., Săcărescu, L., Varganici, C. D., Supramolecular aggregation in organic solvents of discrete copper complexes formed with organosiloxane ligands, *Soft Mater*. **2015**, *13*, 93-105. 5. M. Iacob, D. Sirbu,C. Tugui, G. Stiubianu, L. Sacarescu, V. Cozan, A. Zeleňáková, E. Čižmár, A. Feher, M. Cazacu. Superparamagnetic amorphous iron oxide nanowires self-assembled into ordered layered structures. *RSC Advances* **2015**, *5*, 62563-62570 6. M. Iacob, G. Stiubianu, C. Tugui, E.L. Ursu, M. Ignat, C. I. Turta, M. Cazacu. Goethite nanorods as cheap and effective filler for siloxane nanocomposite elastomers. *RSC Advances* **2015**, *5*, 45439-45446. 7. M. Iacob, M. Cazacu, C. Turta, F. Doroftei, M. Botko, E. Čižmár, A. Zeleňáková, A. Feher. Amorphous iron–chromium oxide nanoparticles with long-term stability. *Materials Research Bulletin,* **2015,** *65*, 163-168. 8. M. Iacob. Sonochemical synthesis of hematite nanoparticles. *Chemistry Journal of Moldova*, **2015**, *1*, 46-51. 9. Dumitriu, C., Cazacu, M., Bargan, A., Balan, M., Vornicu, N., Varganici, C. D., Shova, S., *J. Organomet. Chem*. **2015**, *799-800*, 195-200. 10. Dascalu, M., Musteata, V. E., Vacareanu, L., Racles, C., Cazacu, M., Synthesis and Characterization of Metal-Containing Poly(siloxane-urethane) Crosslinked Structures Derived from Siloxane Diols and Ferrocene Diisocyanate, *RSC. Advances*-**2015,** DOI: 10.1039/c5ra15290a. 11. Dascalu, M., Balan, M., Shova,S., Racles, C., Cazacu,M., Design and synthesis of the first ferrocenylsiloxane urea: structure and properties, *Polyhedron*-**2015,** doi:10.1016/j.poly.2015.11.013. | | | Result indicator | |
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| **Scientific Report:** -  ***achieved indicator***  ***All the objectives of this stage of project – 2015 were achieved!*** | | | Result indicator | |