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# Nanomaterials for smart buildings

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***Abstract*** **- Duetoincreasingpopulationandtheupcomingproblemsintheworld humanshavediscoverednewtechnologiesandnewmaterialsinorder toprogramdailylife.Oneofman'sseriousconcernshasbeenhowtobu ildconstructionsandmanagebuildingssincethebeginningofthehum anhistory.Someoftheseproblemsareresourcelimitations,increasin gpollutionandeconomicchallenges.Therefore,talkingaboutsmart buildingwhicharedynamicandcapableofrepairingthemselvesison eofthemostimportantsessionsbetweenarchitectsandenergyexpert s.Architectureandbuildingtechnologyonthebasisofnanobuildings tructuresandnanomaterialsaregoingthroughsomesignificantchan gesanddevelopments.Nanotechnologyisoneofthemostimportanto utcomesofthetwenty-firstcenturykeytechnologieswhileit'seconomicimpactsarealsorec ognized.Newmaterialsarebeingdiscoveredanddevelopedeveryday asaresultofinvestigatingwaystoachievemolecularandatomicpreci sioninengineeringofmaterial.Thesenewmaterialspresentnewoppo rtunitiestosolveproblemslikeheatabsorbingwindows,energycoati ngandetc...[1].Thususingnanotechnologycouldavoidwastingofene rgyanditcouldbeseriouslyusefulforsavingresources.Thenitcouldd ecreasepollution.Moreover,becauseofdynamicandsmartnatureof nanomaterials, theyareverygoodalternativesinordertosavemoney.Therefore,stud yinghowtousenanomaterialsin construction stylesisincreasing by researchers all over the world daybyday.**

**Keywords:nanomaterial, architecture, natural recourses, environment friendly**

## I. INTRODUCTION

Nanoarchitecturewillallowdesignstointeractbetterwiththehumansenses.
Experiencingthistypeofarchitectureisclosertonatureandlessforcedthanmanyofthedesignsweareexperiencingtoday.
Inarchitectureandtheconstructionindustrynanotechnologyhaspotentialsthatarealreadyusabletoday,speciallythecoatingofsurfacestolendthemfunctionalcharacteristicssuchasincreasedtensilestrength,selfcleaningcapacity,fireresistance,andothers.
Additivesbasedonnanomaterialsmakecommonmaterialslighter,morepermeable,andmoreresistanttowear.Nanomaterialsarenotonly extremely usefulforroofsandfacades;buttheyalsoexpanddesignpossibilitiesforecologicallyorientedarchitects.[3].Bymergingbothnanotechnologyandarchitecture,theadventofnanotechnologywillgivearchitectsrenewedfreedomthatwedon'texperiencetoday.Itisinterestingtothinkofarchitectureasagrowingenvironmentthatevolvesaccordingtodifferentrespectivecodes.Nanoarchitecturecouldtreatsuchcodesorrulesasawaytooptimizeintendedfunctionsandaesthetics.Architecturewouldthenbemoreofadynamicentry,morphingtooccupantneeds.

## II.NANOMATERIALS FOR SAVING ENERGY IN ARCHITECTURE

Smartbuildingsconcerningbiodegradablefeaturesandnanobuildingfacilitiesarecurrentarchitecturalaspectsofspacedesign.Designersshouldbecapableofnewarchitecturalinnovationsasnanomaterialsduringdesignprocess.Thenanohouseisanewtypeofultra-energyefficienthouseexploitingthenewmaterialsbeingdevelopedbynanotechnology.HydroHouseusesnaturalairflowandseawatertocoolandmakethegreenhousehumid.Seawaterisevaporatedatthefacadesofthegreenhouse;asairpassesintothegreenhouse,itincreasesthehumidity.Butthesmartpartisinthestructuralcolumns,whichalsoservesassupportsforthegrowingracks.Whenitrains,freshrainwaterisallowedtotrickledownfromtheroof,withinthecylindricalcolumns.

Inarchitectureandtheconstructionindustry,nanotechnologyiscapableofleadingthebuildingstructureandarchitecturetoanoptimumlevel,forinstancethecoatingofsurfacestolendthemfunctionalcharacteristicssuchasincreasedtensilestrength,selfcleaningcapacity,fireresistanceandmanyothercapacities.Nanomaterialsarenotonlyusefulforsomepartialrequirementslikeroofandfacades;
theyalsoexpandsomedesignpossibilitiesbothforsustainabledesignstrategiesandarchitects.Nanotechnologyonthenearhorizon,maytakebuildingenclosurematerials(coating,panelsandinsulations)toamaximumcapacityofperformanceintermofenergy,light,securityandintelligence.Eventhesefirststepsintotheworldofnanotechnologycouldsignificantlyimprovethenatureofbuildingstructureandefficiencyandthewayourbuildingsrelatetoenvironment.Thedevelopmentofcarbonnanotubesandotherbreakthroughmaterialscouldaffectbuildingdesignandperformance.Briefdefinitionsofnanotechnology,
nanobuildings,smartbuildings,nanomaterialsarethemainapproachesofthistechnology.[1]

## III. NANOMATERIALSPROMOTEGREENARCHITECTURE

Nanomaterialsarepreparedbycleanenergyandtheycanpromotegreenarchitecture.Nanomaterialscouldworkasalivingskinwhichisnotonlygreenintermsofitsfunctionsbutalsointermsofitscomponent.Nanoconstructionmaterialsareintelligentandofaversatilematerialsystemwhichadaptstostructuralloadsandprovideopportunitiestodevelopselfsensingcapabilitiesinthemateri

altoachieveenergyefficienciesandenvironmentalcomfort.Thiscanbeachievedbyintegratingthedesignprocessconstraintswithopportunitiesfromemergingmaterialandconstructionsystems.Thisstrategyenableseachphaseofthematerialsystemdevelopmenttoaccountforcriticaldownstreamdesignconstraintsconstructions,scenariosandefficienciesneededforpossibleselfsustainingsystem,statethisadaptivematerialsystemforthebuildingenvelopetooptimizematerialuseandtointegrateadditionalfunctionssuchasselfsustainingenergyproductionandclimatecontrol.[2].

Intheotherhand,nanolivingsystemsareseriouslydesignedforpublicawarenesstoreduceenergyconsumption.Nanohousedesignwasexpectedtobecomethemostefficienthousedesigninelectricityconsumptiontosolvetheproblemofenergyconsumption.Thesustainablenanolivingconcepthasbeenstudiedinrecentyears.Thesenanomaterialsarebasicallymadeofcarbonatoms.Somefactorssuchassignificantamountofcarbonoutputisalsobeingstudiedtoknowhowmuchexhaustcarbonthesenanohousesproduceandhowmuchthisexhaustcarbonaffectsenvironment.Thenanolivingsystemstudyresultsindicatedthatthenanohouseexhaustcarbonisstillrealisticorevenhassmalleffectonenvironmentsustainability.Thesearebiomimeticnanomaterials,inotherwordssolutionsthatareproducedbystudyingandimitatingthemodelsinnatureorbeinginspiredbythem:Therearemanyproductsthathavebeenproducedafterthefeatureofanimals,plantsorevenorgansandthewaytheyfunction.[4]

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## IV. NanomaterialinServiceofEconomicArchitecture

Nanomaterialcanmakeconstructionsmoreeconomicbecausetheyaretentimeslighterbuthundredtimesstrongerthanregularmaterials.Theyfocusonenergysaving,productivityandprotection.Forexample,carbonnanotubesandothernanomaterialscouldsoradicallytransformourmaterialpalettethatpaper-thinsheetsmightholdupentirebuildings,forcingustocompletelyrethinktherelationshipbetweenstructureandskin.Amaterialthatactslikeapieceofpaperinmanyways,butonethatbringswithitsomany newandexcitingpossibilities isgrapheme. It will, withnodoubthavea multitudeof impacts uponthe builtenvironment.Andsignificantamongthosewillbeontheevolutionofsurface.Carbonnanotubes-sheetsofgraphitejustoneatomthick,arealreadythebuildingblocksforhundredofapplications,usedtoreinforcedconcreteanddelvermedicationtoindividualcells.

Nanocomposites,whichcombinenewnanomaterialswithmoretraditionalonessuchassteel,concrete,glass,andplastics, canbemanytimesstrongerthanstandardmaterials. Alreadyon themarketisanano compositesteelthatisthreetimesstrongerthanconventionalsteel.Intheneearterm,nanocompositereinforcementofsteel,concrete,glass,andplasticswilldramaticallyimprovetheperformance, durabilityandstrength-toweightratioof thesematerials.Beforelong,nano-reinforcedglassmightbeusedforbothstructureandenclosure.Nanotubestructuralpanelscouldmakesomeopportunitiestocreatetransparentloadbearingcurtainwallsfreeofcolumnsandbeams.Quantomdotsmakewallsandceilingslightuporchangecolor withtheflipofaswitch,andnanosensorsinbuildingcomponents createsmartenvironmentsthatconstantlyadapttotheirenvironmentandusers.Already,thisnewscienceofthesmallparticlehas broughtselfcleaningwindows,smog-eatingconcrete,andtoxin-sniffingnanosensorstothemarket.

Aboutthreehundrednanoengineeredproductsarecommerciallyavailableintheworld.Buttheseoff–the-shelfadvancesofferonlyatasteofwhat‘sincubatingintheworldsnanotechlabstoday.Thereworkisunderwayonnanocomposites asthinasglass,yetcapableofsupportingentirebuildings,andphotosyntheticcoatingthatcanmakeanybuildingsurfaceasourceof freeenergy.Theseremarkableeffectsareachievablebecausematterbehavesdifferentlyatthenanoscale ,wherethelawsof quantumphysicstakehold . In thisquantumworld , objects can changecolor ,shape,andphasemuchmoreeasilythanatthemacroscale.Fundamentalpropertieslikestrength,surface-to-massratio,conductivityandelasticitycanbeengineeredtocreate dramaticallydifferentmaterialswhichhaverealeconomicconcerns.

## (1) Acknowledgment

Nanomaterialsmake opportunities to havesmart buildings. Traditionally , the designand constructionofbuildingenvelopesinvolvetheuseofmultiplelayersofdifferentmaterialstoachieveawidearrayoffunctionalities,including strength,lightfiltering,thermalinsulations, soundinsulations, weatherresistanceandarchitecturalappearance.Howeverthislayeringapproachintroduceinefficienciesandalsocreateanumberofjointandinterface,whichultimatelyactasweaklinksinthebuildingenvelopecausingdurabilityproblems.[5].Surelynewmaterials andfieldsofusewillbringnewformsandfunctionstodesignsandtherewillbenewdimensionsin human structureenvironmentrelations.Architects who have come tobefamiliarwithnanotechnologyuseproductsandsystemsthatarelighterbutstronger,environmentfriendlyandthosethatcancleanboththemselvesandtheair,andsocandesignmoresustainablebuildings.Infuture,steelorbrickswillnotbeusedinbuildings.Andthiswillprovidemanydifferentdesign opportunitiesforthearchitectsanddesigners.Theconceptionsandthepracticeofarchitecturewillchange.Nanotechnology‘s “wonder materials“ have thepotential to revolutionize howand whatwe build. Privacy,sustainabilityandsecurity arejustafewoftheissuesthatwillbeprofoundly affectedbynanotechnology.Asthreatsfromterrorismandevenfromnaturalforceslikehurricanesrise,wewillutilizethestrengthof nanotubes to makeourbuildings moresecure.Thedesignandconstruction ofbuildingswill incorporate richnetworkofinteracting,intelligentobjects,fromlight-sensitive,photometricwindowstosmartappliances.Buildingswillnotbestaticbutwillchangeconstantlyastheircomponentscontinuouslyinteractwithusersandeachother.Thesedynamicenvironmentswillbealmostorganicintheirabilitytorespondtochange.Thereforewiththesenewmaterialsarchitectscandesigndynamicbuildingswhicharemorebeneficial.

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