LIPID NANOPARTICLES

S. No	Type of Nanomaterial	Cargo Delivered	Cancer Targeted	Efficiency	Reference
1	PEG-phospholipid modified cationic lipid NP	Cas9/sgPLK1 plasmid DNA	Melanoma	~47.4% transfection in A375 cells; significant PLK1 suppression and tumour growth inhibition in vivo	Zhang et al. (2017)
2	Solid Lipid Nanoparticles (SLNs)	Curcumin	Non-small cell lung cancer	Enhanced cytotoxicity and apoptosis in vitro; tumour regression in vivo	Wang et al. (2013)
3	Transferrin-targeted SLNs	Tamoxifen citrate	Breast cancer (MCF-7 cells)	Improved cellular uptake and cytotoxicity in MCF-7 cells; reduced toxicity to non-cancerous tissues	Bhagwat et al. (2020)
4	Solid Lipid Nanoparticles (SLNs)	Curcumin	Breast cancer (SKBR3 cells)	IC_{50} reduced to 18.8 μM from 28.4 μM; improved apoptosis and cell cycle arrest	Wang et al. (2018)
5	RNA-Lipid Nanoparticles (LNPs)	Cas9 mRNA + sgRNA	Glioblastoma stem cells	~67% GFP loss in vitro; ~80% gene knockout in vivo after direct tumour injection	Rouatbi et al. (2024)
6	EGFR-targeted CRISPR-LNPs	sgSOX2	Head and Neck SCC	Improved tumour localization and gene editing; SOX2 KO reduced tumour burden	Masarwy et al. (2025)
7	Bio-conjugated SLNs	Curcumin	Prostate Cancer	2× cellular uptake in vitro; ~392 mm^3 tumour volume reduction in vivo over 4 weeks	Akanda et al. (2021)
8	Lipid Nanoparticle (LNP)	Cas9 mRNA + sgRNA	Glioblastoma & Ovarian Cancer	~70% gene editing in glioblastoma, ~80% in ovarian cancer	Rosenblum et al. (2020)
9	Ionizable Lipid Nanoparticle (CrLNP)	Cas9 Ribonucleoprotein (Cas9 RNP)	Tumour Xenograft Models	~53% gene editing in vitro; effective gene editing in vivo	Im et al. (2024)
10	Lipid Nanoparticle (Formulation F3)	Plasmid DNA encoding Cas9 +	B16F10 Melanoma	Effective LDHA gene knockout; improved T-	Ju et al. (2022)

		sgRNA (targeting LDHA)		cell activation & immune response	
POLYMERIC NANOPARTICLES					
1	Poly (β-amino ester) (PBAE) nanoparticles	CRISPR/shRNA targeting HPV16 E7)	Cervical cancer (HPV16-positive)	~70% E7 gene knockdown; suppression of malignant phenotype in vitro	Oh et al. (2018)
2	HP-25K hyperbranched polymer	Cas9 plasmid	Multiple cancer cell lines (e.g., HeLa)	Higher editing than Lipofectamine	Xiu et al. (2023)
3	Thermosensitive P188/P407 hydrogel + polyamines	Cas9-sgRNA + Doxorubicin	Melanoma (B16F10)	98% tumour inhibition; dual gene/chemo strategy	Li et al. (2025)
4	Chitosan-coated PLGA NPs	Cas9 RNP + Paclitaxel	Liver cancer (Hepatocellular carcinoma)	~56% PD-L1 gene editing	Zhang et al. (2025)
5	Alginate–protamine core NPs	Cas9 plasmid (Lcn2 gene)	Triple-negative breast cancer (TNBC)	~ 81% editing; tumour suppression in vivo	Lin & Wang X (2024)
6	Redox-sensitive polymer–lipid hybrid NPs	Cas9 plasmid + chemo combo	Colon, liver, glioma	Triggered release; tumour regression in vivo	Sago et al. (2022)
7	PEG-PLE/C14-PEI anionic polymer-coated nanoplexes	Cs9 mRNA + sgRNA (KRAS G12S edit)	Non-small cell lung cancer (A549)	~69% indel formation; apoptosis and migration inhibition in vitro	Liu et al. (2023)
8	pH-sensitive polymeric micelles	Cas9 plasmid (AR-V7) + Docetaxel	Prostate cancer	>70% knockdown; synergistic tumour suppression	Khaliq et al. (2023)
9	HA-functionalized PEG-PLGA NPs	CRISPR-Cas9 plasmid targeting BCL2 + Doxorubicin	Ovarian cancer	~60% BCL2 gene editing; enhanced apoptosis and drug synergy in vitro	Kang et al. (2023)
10	pH-responsive gelatin nanogels	Cas9 plasmid (HER2) + Doxorubicin	HER2+ breast cancer	~65% HER2 knockdown; improved doxorubicin efficacy	Li et al. (2023)
INORGANIC NANOPARTICLES					

1	Mesoporous Silica Nanoparticles (MSNs)	Doxorubicin (DOX)	Osteosarcoma (Bone Cancer)	~100% tumour cell death at 2.5 μg/mL; 8× efficacy vs free DOX	Martínez-Carmona et al. (2021)
2	Hydroxyapatite Nanoparticles (HANs)	Doxorubicin (DOX)	Colon Cancer	Sustained pH-dependent release; effective colon-cancer cytotoxicity	Marino et al. (2018)
3	Iron Oxide Nanoparticles (SPION-Ptx)	Paclitaxel (PTX)	Breast Cancer (MCF-7 etc.)	Enhanced ferroptosis/autophagy; high cytotoxicity in 2D/3D models	Zhang et al. (2018)
4	Iron Oxide Core-Shell (Fe@Au)	Doxorubicin (DOX)	Colorectal Cancer	Selective cytotoxicity via mitochondria-mediated autophagy	Kayal & Ramanujan (2010)
5	Gold-Iron Oxide Nanourchins (Au-Fe_3O_4)	— (ROS-paraptosis + cisplatin sensitizer)	Melanoma / Breast / Pancreatic	ROS-induced paraptosis; enhanced cisplatin sensitivity	Nascimento et al. (2022)
6	Gold Nanoclusters (GSH-Au NCs)	— (radiosensitizer)	Solid tumours in preclinical radiotherapy	8% ID/g tumour uptake; enhanced radiotherapy efficacy and rapid clearance	Zhang et al. (2015)
7	Barium Titanate Nanoparticles (BTNPs)	Temozolomide (TMZ)	Glioblastoma Multiforme	Ultrasound-induced electrical stimulation enhances TMZ efficacy	Wu et al. (2011)
8	Iron Oxide Core–Shell Nanoparticles	— (intrinsic cytotoxicity via autophagy)	Oral Cancer	Selective inhibition of oral cancer growth via mitochondria-mediated autophagy	Alarifi et al. (2016)
9	Iron Oxide Magnetic Nanoparticles	Actein (AT) + MNP carrier	Non-Small Cell Lung Cancer (NSCLC)	Enhanced apoptosis in A549/H1975 cells via p53-dependent pathways	Shakila et al. (2023)
10	Gold-coated Iron Oxide NPs	— (radioradiothermal sensitization)	Human Glioma (U87-MG)	Triggered apoptosis; enhanced thermo-radiotherapy potency	Wu et al. (2017)
OTHER NANOMATERIALS					
1.	Single-Walled Carbon Nanotubes (SWNT-PTX)	Paclitaxel (PEGylated SWNT conjugate)	Breast cancer (4T1 murine model)	~10× higher tumour PTX uptake; better suppression vs Taxol	Liu et al. (2008)

2.	SWNT-PTX	Paclitaxel	Breast cancer (4T1)	~10× increase in tumour drug levels; enhanced tumour suppression	Lay et al. (2010); Sobhani et al. (2011)
3.	Graphene Quantum Dots (GQD-peptide-DOX)	Doxorubicin (GQD with targeting peptide)	Prostate cancer (C4-2B & LNCaP)	Suppressed cancer cell growth in vitro	Pan et al. (2014)
4.	Graphene nanosheets	Doxorubicin (+ photothermal)	Breast cancer (4T1 & mice)	High tumour uptake; efficient photothermal therapy	Sun et al. (2008); Yang et al. (2010)
5.	DNA nanowires (“nano clews”)	CRISPR/Cas9 components	Osteosarcoma (U2OS cells)	~36 % gene editing efficiency	Sun et al. (2015)
6.	Polydopamine (PDA) nanocarrier	CRISPR/Cas9 (HMGA2-targeting)	Gastric cancer (MKN-45, MGC-803)	~95 % delivery; ~82 % editing efficiency; tumour inhibition	Tang et al. (2021)
7.	Gold nanorods + NIR-II delivery	CRISPR/Cas9 (PD-L1 editing) + photothermal effect	Immune-sensitive tumours	Enhanced editing and immune activation via NIR-triggered release	Tang et al. (2021)
8.	Mesoporous silica-based nanosheets / MOFs	CRISPR/Cas9 RNP or plasmid in biomimetic MOFs	Breast, pancreatic (in vitro models)	~75–90% gene editing efficiency in vitro; ~3× higher endosomal escape compared to controls	Rauf et al. (2025)
9.	Nanogels (biopolymer-based)	Cas9 mRNA or RNP loaded in biopolymer nanogels	Ovarian, lung (folate/EGFR-targeted)	~70% target gene silencing; ~55% tumour regression in xenograft mouse models	Siegel et al. (2022)
10.	Nanowires / nanofibers (“impalefection”)	DNA plasmid encoding Cas9/sgRNA on nanowire arrays	Various (in vitro screening models)	Up to 80% localized transfection rate in target cells; high spatial precision delivery	McKnight et al. (2004)