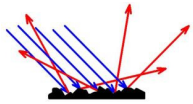
What is polishing?

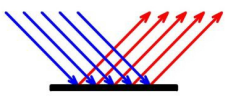
"The act of changing a concrete floor surface, with or without aggregate exposure, to achieve a specified level of gloss." – *Concrete Polishing Association of America*

- Polishing is a process of removal and refinement.
- High quality polished concrete has a high gloss and is very flat for crisp, low-distortion reflections

Surface Profile and Sheen

- Rough surfaces scatter white light and look dull and washed out
- Polishing gradually smoothes surface
- Scratches and pits get smaller and less visible
- Very smooth surfaces reflect more visible light


Rough Surface

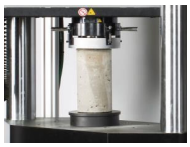

Smooth Surface

Requirements for Polishing

1. Quality, well cured concrete
2. Diamond polishers and pads
3. Densifiers

1. Concrete Requirements

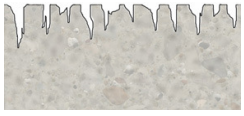
- Compressive strength >5000 psi at time of polishing
- Low w/c ratio (< 0.40)
- Sound aggregates
- Dense composition
- Well cured for 7+ days (14 days or longer is better)

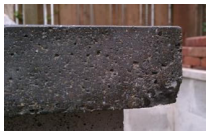


Concrete Requirements

Low surface porosity

- Holes and voids can't be polished
- Hole edges can dust and crumble
- Good casting and grouting yields better shine
- Densifiers won't fill in pinholes

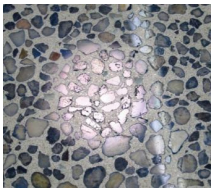


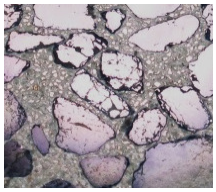


Concrete Requirements

Higher surface hardness yield higher shine

- Glass, quartz and harder aggregates polish very well and contribute to most of the shine



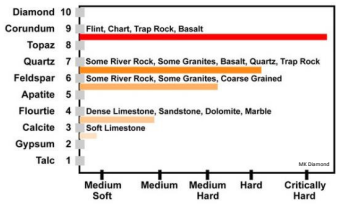


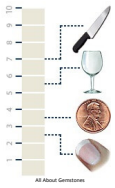
- Cement paste and softer aggregates must first be hardened and filled to yield satisfactory shine

Concrete Requirements

Higher surface hardness yield higher shine

- Hard aggregates (quartz, glass, granite, etc)
  - Typical Mho's hardness for concrete: 4-8



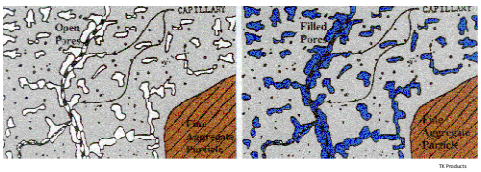


Mohs Scale

Concrete Requirements

Dry

- New concrete (< 7 days) has free pore water
- Wet processing fills capillaries and pores
- Densifiers can't penetrate wet concrete



Concrete Requirements

Source of available calcium

- Portland cement generates calcium hydroxide (CH) during curing. Longer curing = more CH
  - Most densifiers react best with free calcium
- CSA cements don't produce much or any CH
  - Most densifiers won't react with CSA cement
  - Colloidal silica densifiers will harden CSA.

2. Polishing Machines

- **Wet Polishers**
  - Single head
    - Electric
    - Air
  - 3 head planetary
- **Dry Polisher**
  - Single head
    - Electric, variable speed
  - 3 head planetary

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How to Use Polishers

- Polishers are always used flat, never tilted.
- Begin with the polisher off, flat on the concrete
- Turn on water, use just enough water to eject cuttings (wet polishers)
- Start polisher while in full contact with surface
- Keep polisher moving at a steady pace in an even pattern
- Keep polisher flat and in full contact with the surface
- To stop, first lift the polisher off the surface, then shut the machine off (except for planetary polishers).

Diamond Tooling

- Hand pads

- Metal-bond turbo cups

- Resin polishing pads
  - Wet
  - Dry

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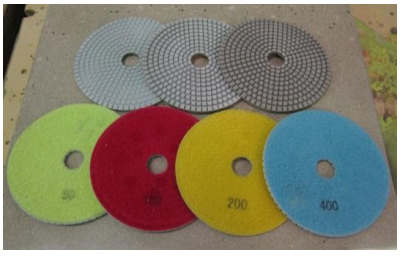
Diamond Pad Selection

- High concentration of diamonds for faster cutting
- **Narrow gradation of diamonds for a swirl-free surface**
- Thick enough for long life
- Thin enough to be flexible
- Ideal channel design to eject slurry and prevent clogging
- Ideal resin binder for long life without glazing

Diamond Pad Selection



CCI diamond pads available at www.ConcreteCountertopInstitute.com/diamonds.

Be aware that many other pads are designed for granite, not concrete, and many thicker pads are designed for flooring machines.

Grit Progression

- Coarse diamonds leave coarse scratches
- Finer diamonds remove coarse scratches, leaving finer scratches
- Polishing leaves finer and finer scratches until they are no longer visible

Grinding, Honing and Polishing

Grinding:

- Heavy cutting with turbo cup (wet)
- Rough, aggressive (30 grit). Used to shape, flatten & expose aggregate.

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Grinding, Honing and Polishing

Honing:

- Light material & scratch removal
- No sheen
- 50 grit – 200 grit
- Best done wet

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Grinding, Honing and Polishing

Polishing:

- Sheen, gloss development
- 400 grit – 3000 grit
- Wet or dry

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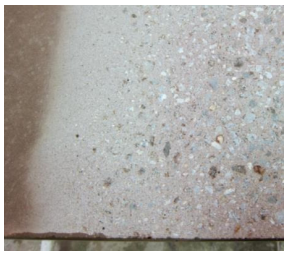
Surface Appearance

Coarse grind and 50 grit hone:

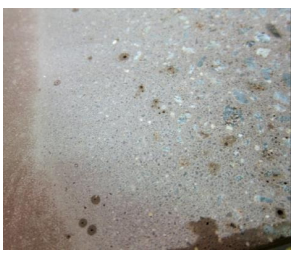
Coarse grind: 30 grit cup wheel



Wet hone: 50 grit

Surface Appearance

200 grit hone and 800 grit polish:

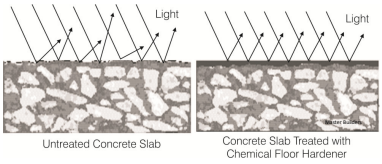


Wet hone: 200 grit

Wet polish: 800 grit

3. Densifiers and Sheen

- Chemical densifiers harden the cement paste
- "Guard" type densifiers coat the surface with a micro thin film and help enhance color and gloss.



Definition

Densification:

The process of permanently closing microscopic pores in the top layer of the slab by adding chemically reactive silicate compounds to the concrete surface.

- Silicate compounds react with available calcium hydroxide (CH – weak, filler) and produce additional calcium silicate hydrate (CSH – strong, glue)

Chemical Treatment

Densifiers form more CSH gel that:

- Hardens the cement paste
- Plugs capillaries and micro-pores
- Fills in microscopic-scratches*

* Not visible to the naked eye

Types of Densifiers

- Siliconates
- Silicates
  - Sodium
  - Potassium
  - Lithium
- Colloidal Silica

Densifiers: Siliconates

- Sodium & potassium
  - High pH (12+), faster reaction with CH
  - Can cause whitening if not applied properly
  - Not an effective densifier/hardener
  - Larger molecules penetrate less
  - Functions as a pore-filler/sealer
  - Water beading action

Densifiers: Silicates

- Sodium & potassium
  - High pH (12+), faster reaction with CH
  - Requires rinsing, residue is alkaline and water soluble
  - Can cause whitening if not applied and rinsed properly.
  - Larger molecules penetrate less
  - Cheaper, older, poorer choice
  - **Avoid using**

Densifiers: Lithium Silicates

- Lithium Silicate
  - Lithium compounds offer ASR protection
  - Higher pH (11), faster reaction with CH
  - Generally won't cause whitening, no rinsing
  - Smaller molecules penetrate more
  - An effective densifier/hardener

Densifiers: Colloidal Silica

- Colloidal Silica
  - Not an alkali-metal compound like -silicates
  - Lower pH (9), faster reaction with CH
  - Won't cause whitening, no rinsing needed
  - Very small molecules (3-5 nm) penetrate deeply
  - Fast reaction time (minutes)
  - An effective densifier/hardener
  - The only densifier that works with CSA cements

Densifier Misconceptions

- "Fixes" poor concrete
- Fills in pinholes and scratches
- Works instantly
- "Seals" concrete and gives it stain protection
- Makes concrete acid resistant

Densifier Application

Apply only after:

- Grinding is completed,
- Grouting is completed,
- Honing to 200 grit,
- Letting concrete dry

Densifier Application

Application process (for each densification stage):

- Soak concrete to saturate
- Let dwell for 10-20 minutes, keep wet
- Add more densifier as it soaks in
- Mist with water if gelling/drying occurs
- Wipe off excess densifier upon rejection
- Let dry & react – hours to overnight (best)

Densifier Application

Application process (Vseal 101 shown):

Densifier Application

Densifiers/Hardeners are best used in sequence:

1. Siliconate (bigger) to first plug larger pores*
2. Lithium silicate (smaller) to densify and harden
3. Colloidal silica (smallest) to harden and fill micro pores*

* The pores are holes and microcapillaries invisible to the naked eye; they are not pinholes that you fill with grout.

Recommended Polishing Process

Pre-Densification: These steps can happen before or after concrete cures for more than 7 days (usually before):

1. Grind or hone (wet) to achieve desired surface appearance and aggregate exposure
2. Grout pinholes and voids
3. Hone (wet) to 200 grit

Recommended Polishing Process

Densification: These steps should happen only after the concrete has cured for at least 7 days:

1. Densify in stages (siliconate, lithium silicate)
2. Polish wet 400 to 1500 grit, let concrete dry
3. Apply colloidal silica
4. Dry polish 1500, then 3000 grit

Finished Polished Surface

Concrete Processing: Wet vs Dry

Wet Processing

- Faster
- No dust
- Assists wet curing

- Fewer/no scratches
- More tooling choices

Concrete Processing: Wet vs Dry

Wet Processing

- Messy
- Requires water source
- GFCI for electric polishers

- Saturates concrete pores
- 3000 grit yields duller surface than dry

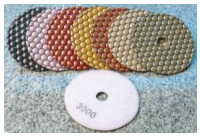
Concrete Processing: Wet vs Dry

Dry Processing

- Better shine
- Easier to see effects
- Friction helps densifiers
- Less aggressive

Concrete Processing: Wet vs Dry

Dry Processing



- Slow at coarser grits
- No water to flush cuttings
- Scratches far more likely
- Variable speed polisher necessary
- More skill needed
- Dust is hazardous, HEPA vacuum required

Concrete Processing: Wet vs Dry

Dry Processing Safety

- Dust mask (N95 or better)
- HEPA vacuum
- Dust shroud

Polishing Comparison

Cream finish, 800 grit (same piece of concrete!):


Wet polish 800 grit


Dry polish 800 grit: More sheen, but lots of scratches and the color is darkened.

Polishing Comparison


Wet polish 3000 grit + hog's hair buffing.


Dry polish 3000 grit

Wet vs Dry Polishing

Wet polishing leaves a slightly duller surface

- More noticeable in cement cream finishes
- Higher quality at coarser grits
- Few, if any scratches
- Faster rpm, faster cutting
- Water cools pad and flushes cuttings
- No burnishing, no friction heating, no surface packing, no resin smear
- Buffing with hog's hair pad brings out shine

Wet vs Dry Polishing

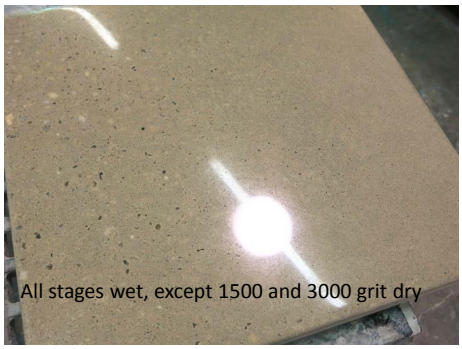
Wet vs Dry Polishing

Wet vs Dry Polishing

Dry polishing achieves a higher gloss

- More noticeable in cement cream finishes
- Pad friction creates heat, softens resin
- Cuttings stay under pad face longer, break down and get packed into surface pores
- Cuttings and fractured diamonds act as finer grit that burnish surface and improve gloss

Wet vs Dry Polishing



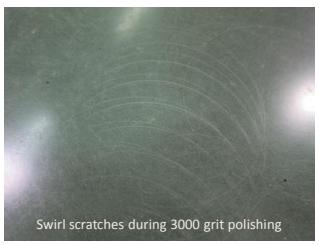
Dry Polishing

Downsides to dry polishing:

- Only very hard surfaces polish well and easily
- Young/cement cream surface scratches easily
- Speed, pressure and pad angle are important
- Any loose diamond or coarse grit can cause deep scratches
- Resin pads can glaze over, cause smearing and create discoloration from pad residue.

Dry Polishing Troubles

Downsides to dry polishing:



Keys to Success

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